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C O M M E N T A R I E S
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A P H O R I S M S
O F

Dr. HERMAN BOERHAAVE,

The late learned Profeffor of Phyfic in the
Univerfity of L E Y D E N,

C O N C E R N I N G

The KNOWLEDGE and CURE of the feveral
DISEASES incident to HUMAN BODIES.

By GERARD VAN SWIETEN, M. D.

Translated into ENGLISH.

V O L. XVI.

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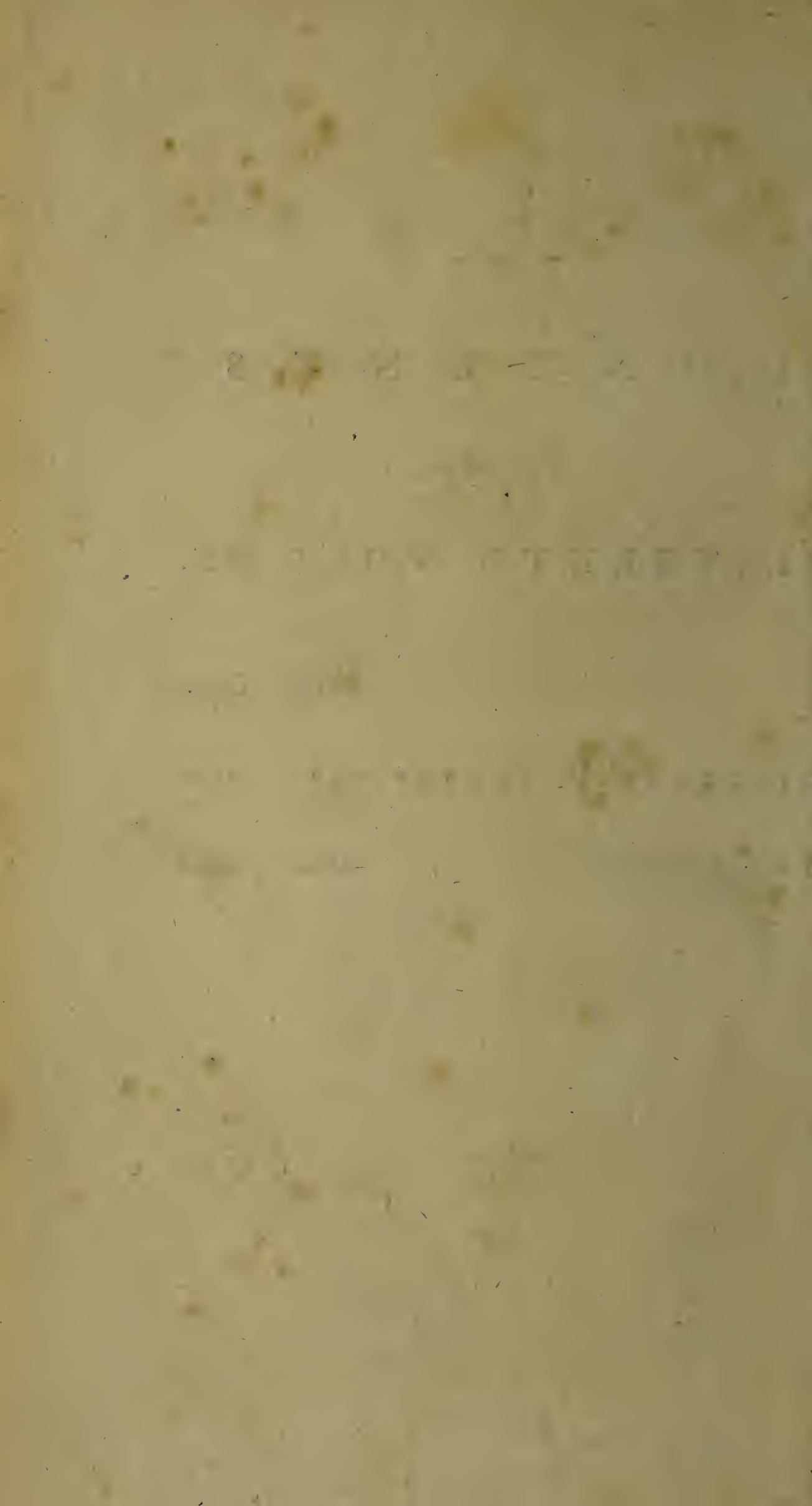
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COMMENTARIES

UPON THE

APHORISMS

OF

HERMAN BOERHAAVE,

CONCERNING THE

KNOWLEDGE and CURE of DISEASES.

EPIDEMIC DISEASES.

SECT. MCCCCIV.

ABOVE all things it ought to be observed, that the diseases of the fluids hitherto described, though they seem the same to the unwary from their name, most of their symptoms, and from some appearance of the same event, yet from an hidden quality, and phænomena scarcely noticed except by the most skilful and experienced practitioners, at the different times of the increase, height,

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coction

coction or crisis, they differ prodigiously as to their effects, event, and method of cure.

Hitherto we have treated of internal diseases, and have copiously described their history and method of cure. The next object of our consideration, is the change sometimes observed in diseases, that does not depend on the peculiar and individual genius of each distemper, but proceeds from another cause frequently very hidden, through which it happens that a disease attacking several persons, may be very different from a disease of the same name that has been before observed. Thus in the history of Fevers, § 566. it has been taught, that a fever is either Epidemic or common, or particular to this or that person; and it has been said in § 584, that the causes of fevers are likewise two-fold, because they are either peculiar to each individual, or universal or common to many, which last are generally owing to the same air, food, or way of life. It has also been shewn in the history of Intermittent fevers, that *Vernals* are altogether different from *Autumnals*, that the nature, symptoms, issue, duration, and cure of both are utterly unlike. Thus the *Ephemera*, see § 728, the most simple of continual fevers, completing within the space of twenty-four hours, its increase, height and declension, is easily cured, and passes through its different stages without the least danger. Yet the *Ephemera*, called the British, excellently described by Caius, an Englishman, made vast havock. Both diseases were called by the same name, their time of duration was the same, but they terminated very differently. The common *Ephemera* is no ways dangerous, the British, called also the Sweating Sicknes, carried off great numbers often within a few

few hours, and was quickly dispersed by contagion through whole nations. Whence it afterwards acquired the name of the Pestilential Ephemera. In either disease sweats break out; mild and gentle in the common ephemeræ, terminating the disorder by a quick crisis; in the sweating sickness so profuse, as entirely to exhaust a robust man in the space of a few hours; yet this discharge could not be encouraged without present imminent danger of life.

I have known an epidemic pleurisy resist the usual method of cure, nor bear repeated plentiful venesection, but happily cured by a free use of emollient decoctions, and large and frequent doses of oleaginous medicines.

The plague itself has sometimes lain concealed under the mask of other diseases. When the plague raged at Vienna in the thirteenth year of the present century, it frequently assumed the appearance of a pleurisy, catarrh, or quinsy (*a*). Soon after buboes and carbuncles, most certain signs of the plague, broke out, accompanied with the usual symptoms. Sydenham (*b*) who with the utmost care has investigated the genius of diseases, teaches, that while a particular epidemic constitution of the air prevails, intercurrent diseases participate of the genius of the reigning epidemic, although entirely different therefrom in their own nature. Thus for instance while the small pox rages epidemically, continual intercurrent fevers have many symptoms the same as those of the small pox, while the state of contagion prevails, but want those which accompany the eruption and suppuration of the pocks. Thus he remarks (*c*) that a pleurisy (symptomatic he calls it) accompanied the fever which prevailed in the winter of the year 1675; but all those pleuritic patients, on

(*a*) Wiener Pest Beschreibung und Infections ordnung. pag. 245. (*b*) Sect. vi. c. 1. pag. 327, 328. (*c*) Ibid.

the first attack of the disease complained of pains in the head, back and limbs, which were the surest and most common symptoms of the disease then epidemically raging. However he says, great penetration and the most attentive observation are necessary to form this diagnostic, that the physician “ upon inspection may immediately be able to distinguish the nature of the disease, though the other symptoms of different characteristics may be perhaps so subtle and delicate that he cannot explain the same to another by words.”

The truly great Sydenham very frequently inculcates this, that physicians ought to be always attentive to the epidemic constitution that prevails, while they are treating even other disorders. “ For as often as any particular constitution of the air produces various species of epidemics, every one of these in their kind, differ from those which though they plainly are entitled to the same name, may be generated by another different state of the air (*d*). Because the predominant epidemic governs also other intercurrent diseases. “ For it is to be remarked that whenever various kinds of them rage at one and the same time, they all agree in the manner in which they first attack the patient and in the symptoms of invasion (*e*).

Hippocrates seems to have called this latent cause of epidemics *το Θείον*, and excellently confirms the doctrine of Sydenham (*f*). The following are his words: *Debet autem morborum ejusmodi naturas cognoscere, quantum corporis vires exsuperent, simulque & si quid divinum in morbis insit, hujus præcognitionem addiscere. Debet autem differentiam morborum, assidue in vulgus grassantium, cito animad-*

(*d*) Sect. 1. c. 2. p. 51. (*e*) Ibid. (*f*) Prognostic. text. 4 ch. tom viii. p. 585.

vertere, nec temporis statum ignorare. Sic enim eum omnes merito admirabuntur, & bonus erit Medicus. Namque & eos, qui servari possunt, multo etiam melius servare poterit, longe ante singulorum curationem præmeditatus &c. “ But he ought to know the
 “ nature of diseases of the same kind, how much
 “ they may exceed the strength of the body, and
 “ also if any thing more than human is in the
 “ disease, should learn to discover it. He
 “ ought besides readily to observe the difference
 “ of the diseases daily raging among the public,
 “ nor be ignorant of the state of the season. Thus
 “ the world will justly admire him, and he will be
 “ esteemed a good physician. For having studied
 “ long before the cure of each, he will be far
 “ better able to assist those who may be capable of
 “ receiving assistance” *etc.* In like manner he inculcates in another place (g) “ the physician ought
 “ early to be acquainted with epidemical diseases,
 “ nor be ignorant of the constitution of the air.”

For although, as will be mentioned hereafter at § 1408, the cause of epidemics cannot always be discovered from the change of the weather, yet it is admitted by all that the sensible qualities of the circumambient air are also to be considered by physicians, because they may help, or do harm in diseases. (b) *Si statis temporibus tempestive anni tempestates succedant, morbi bene morati, & judicatu faciles, oriuntur. Male vero constitutis, male morati, ac intempestivi, difficilisque judicii.* “ If the seasons
 “ of the year succeed each other regularly at the
 “ stated periods, diseases well-conditioned, easy of
 “ cure, and of which a judgment may easily be
 “ formed, arise. But if otherwise, the reverse.”
 He elsewhere repeats the same prognostic; and

(g) Ibid. p. 687. (b) Aphorism viii. sect. 3. chart. tom. ix. pag. 97.

presently subjoins (i) *Quales in Perintho grassantur, quando quid defecerit, aut exsuperaverit, aut flatus (ventorum), aut non flatus, aut aquæ, aut siccitates, aut ardores, aut frigora, &c.* “Such as rage in Perinthus, when any thing has been deficient, or in excess, either gales of wind, or calms, or rains, or a dry season, or excessive heats or colds, etc.” Indeed, in many places Hippocrates describes diseases which owe their cause chiefly to the sudden changes of the seasons of the year. Nay he makes the following remarks on constitutions. (k) *Naturarum quædam ad æstatem, aliæ ad hyemem, bene aut male se habent.* “Summer agrees best with some, winter with others.” Since the effects of the same disease may be different according to the various constitution of the patient, it is manifest that the seasons of the year also merit attention in the cure of diseases.

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AND therefore require a very different administration of the six non-naturals; a different method of cure; different medicines.

Since therefore so remarkable a difference may be observed in diseases of the same name, while this or that epidemical constitution prevails, it is plain that the method of cure ought to be different. Therefore those diseases called by Sydenham intercurrent, which have been spoken of in the preceding paragraph, do not indeed altogether require the same treatment, but the epidemical disease then prevalent, at least the peculiar characteristic disposition of such epidemical disease is

(i) Epidem. lib. 2. text. v. ibid. p. 119. (k) Aphorism 11. Sect. 3. Ibid. pag. 93.

also always to be considered. Thus for instance, the pleurisy demands plentiful, mostly, repeated venesection: but if the reigning epidemical disease will not bear without injury, plentiful or repeated bleeding, at such a time the prudent physician will direct venesection more sparingly in the cure of that disorder. Especially it is to be considered by what emunctories of the body nature may expel the morbid matter when concocted; for the same is usually done with success in intercurrent diseases, though different from the epidemical disorder. Thus if the epidemical disease is usually happily terminated by a critical sweat, the same may be rationally expected in a pleurisy, because also that distemper sometimes naturally terminates by sweats. Therefore warm aqueous small liquors should be administered freely, which may gradually dispose the body to that critical sweating, and yet can never do harm in the cure of a pleurisy. Sydenham has very discreetly advised this in treating of these diseases (1): “ In
 “ which case that method is not to be followed,
 “ which they demand, whenever they are essential
 “ diseases, but rather that which the disease re-
 “ quires itself to which the symptoms belong,
 “ to the cure of which indeed that is only slightly
 “ to be inclined.”

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YET whose cause of variety is so latent, that it cannot hitherto be deduced from any sensible defect of the non-naturals.

What physicians mean by the six non-naturals, has been frequently explained as well in § 586,

(1) Sect. 6. c. 1. pag. 326.

where the causes of fevers are enumerated, as in other places. But there cannot be the least doubt, that by the improper use of the six non-naturals, diseases may be produced, and indeed such as at the same time attack several persons, if the same defect or excess in eating, drinking, &c. were common to several. Thus for instance; in a scarcity of provision in besieged towns, from the use of damaged corn, a want of vegetable food, drinking of putrid water, and the like causes, various diseases arise which seize the generality of the inhabitants, if by their way of living exposed thereto. But by these vices of the non-naturals, is not understood that latent cause which changes other distempers into its own species after the manner of epidemics. For they who live in the same place, and are able to use better food, continue free from these disorders. Thus in besieged towns, the common soldiers, and populace suffer from diseases that arise from a scarcity of provisions, while the officers and wealthy citizens still enjoy a good state of health. Nay, while the besieged are terribly afflicted with such diseases, the besiegers, provided they are well supplied with wholesome food, continue healthy.

Hippocrates hath wisely laid down the following aphorism: (m) *Morbi oriuntur, partim quidem ex vivendi ratione, partim vero ex spiritu quem introducendo vivimus.* “Diseases arise, partly indeed from
“the way of living, but partly from the air which
“we breathe.” He afterwards describes how epidemical diseases may be distinguished from others: *Diagnosim autem utrorumque ita facere oportet. Quum multi homines uno morbo corripuntur eodem tempore, in id quod maxime commune est, quoque omnes utimur po-*

(m) De Natura Homin. &c. 2 & 3, chart. tom. III, pag. 131.

tissimum rejicienda causa est. Id autem est, quod inspirando trahimus. Quod enim vivendi ratio cujusque nostrum in causa non sit, jam liquido constat, quum morbus omnes continentur attingat et juvenes et senes, et mulieres et viros, perindeque temulentos et abstemios, tam eos qui Maza, quam qui pane, vescuntur, et eos, qui multis, quam qui paucis, exercitationibus utuntur. Non igitur victus rationi assignanda causa est, quum cujusvis generis victu utentes eodem morbo corripuntur.

“ But it behoves the physician to make a diagnostic of each in the following manner. When many are seized with the same disease at one time, the cause is chiefly to be attributed to what is most common, and made use of by all. This is certainly what we inhale in inspiration. For that the way of living of each of us is not the cause now clearly appears, since the disease continually attacks all, both young and old, women and men, free livers and abstemious persons, as well those who live upon flummery, as those who eat bread, and those who use much, equally with those who take little exercise. Therefore the cause is not to be ascribed to the way of living, since those who make use of every kind of food, are equally seized with the same disease.” Whence he instructs us that in the cure of particular diseases, the way of living may be blamed, if it hath been faulty. But, when any epidemic disease is rife, (n) *admonendi sunt homines, ut ne victus quidem rationem immutent, quum morbi causa minime existat. Provideant tantum, ut corpus quam minime intumescat, sitque attenuatissimum, tum cibos tum potus, quibus uti consueverint, sensim demendo. Si quis enim subito victus rationem immutet, ne quid in corpore ex immutatione innovetur, periculum est.* “ Mankind are to be admonished,

(n) Ibid. c. x. t. 4 &c. p. 132.

“ not to change their way of living, since the
 “ cause of the disease does not depend thereon.
 “ But only to be careful that the body may be
 “ puffed up as little as possible, and on the contra-
 “ ry may become much leaner by gradually lessening
 “ the quantity of their usual meat and drink. For
 “ if any one suddenly changes his manner of living,
 “ there is danger lest by the change some innova-
 “ tion should happen in the body.”

It therefore is evident that Hippocrates, would not have the diet changed while popular diseases rage; but only recommends a spare diet; the utility of which is confirmed by faithful observations. Caius, an Englishman (o) hath declared, that the English who delighted in a plentiful table and a variety of food, were more than others, and indeed almost solely attacked by the sweating sickness, *Indicio est annus hic pestifer, qui exteris infestus non fuit, atque ex nostris nullos æque pressit aut absumsit, atque bene saginatos, otio & quieti per superiorem vitam deditos. Nam miseram illam & jejunam plebeculam, belli pacisque laboribus duratam, aut omnino non attigit, aut sine gravi noxa vel periculo.* “ Witness this pestiferous year which was
 “ not dangerous to foreigners, and neither equally
 “ affected or carried off our own people, but only
 “ the well fed, and those devoted to ease and quiet
 “ from their superior rank in life. For the wretch-
 “ ed ill-fed populace, inured to the hardships of
 “ peace and war, either escaped the disease entire-
 “ ly, or were but slightly attacked with it. He else-
 where remarks (p) that the Scots who inhabited the same island, and the French who were there at that time on an embassy wholly escaped the distemper. On another occasion at § 11, the following text of Galen has been quoted: *Corpore nostro ad morbos*

(o) De Ephem. Britan. p. 62. (p) Ibid. p. 40.

quasi præparato, externum quoddam adveniens accendit febrim, quod ex se morbum vehementem minime generaret, &c. ; *Et, propter corporis dispositionem, unumquodque horum, non morbi causa, sed occasio, redditur, has causas vocaverunt προφάσεις.* “ In our
 “ bodies as it were prepared for diseases, some external adventitious circumstance kindles a fever,
 “ which of itself would not generate a violent disease, &c. yet from the disposition of the body,
 “ every one of these, is rendered, not the cause of the disease, but the occasion, these causes have
 “ been called προφάσεις.” (q) Whence errors committed in point of diet, may indeed predispose the body, to be affected more easily and more severely by any occasional or exciting cause; but without that will never alone occasion an epidemical disorder. If for instance a person should get very drunk, at a season of the year, when no quartan agues made their appearance, he would not get a quartan ague; but at another season when quartans were epidemic, he would be attacked by that distemper even from a much less error in diet. Wherefore Galen (r) has laid down the following observation: *Hujus semper meminisse oportet toto hoc sermone, quod nulla causa, sine corporis aptitudine, efficere possit; alioquin omnes, qui in sole versantur æstivo, in febrim inciderent, Et qui plus æquo moventur, aut irascuntur, aut moerent. Nec secus, omnes ægrotarent circa canis fideris ortum, aut peste perirent.* “ It is
 “ necessary always to remember throughout this whole discourse, that no cause can affect, without
 “ a predisposition of the body; otherwise all who are exposed to the rays of a summer sun, would
 “ be seized with fevers as well as all those who use too much exercise, are passionate, or grieved.

(q) Comment. iv. in Hippocrat. de Victu, tom. ix. p. 178

(r) De febribus, lib. 1, ch. 6, chart. tom. vii. p. 112.

“ Moreover, all would fall sick, during the dog-
 “ days, or die of the plague.” In the mean
 while no pestilence has ever been so violent as to
 kill all: for many though constantly exposed to
 the contagious effluvia have escaped being infect-
 ed; in whom therefore there did not exist a predif-
 position to receive the infection. In the preceed-
 ing chapter it has been remarked that persons who
 have once had the small pox, have undergone such
 a change, that they are very seldom capable of re-
 ceiving the variolous infection a second time.

We may therefore conclude that this exciting or
 procatactic cause is not to be sought in the abuse,
 or defect of the six non-naturals; but that it is
 far less obvious, so that the most experienced phy-
 sicians have often acknowledged, that they were
 wholly ignorant with respect to this latent cause of
 epidemics, which only shows itself by its effects
 on the human body, while its own specific genius
 is unknown. Hence Sydenham has asserted (s)
 “ That they labour in vain who attempt to deduce
 “ the rationale of different fevers from the mor-
 “ bific cause congested in the human body: for
 “ it clearly appears that if any person in perfect
 “ health should remove to any place in this king-
 “ dom, where an epidemic disease rages, in a
 “ few days he will be seized with it, though it is
 “ scarcely credible that any manifest change should
 “ be made in the juices of the same person by the
 “ air in so short a time.”

This latent epidemic, as has been observed, dis-
 turbs the order of other intercurrent diseases, and
 obliges physicians to incline the cure of these to the
 genius of the prevailing epidemic: But in the prin-
 cipal of epidemic diseases, namely, the dire pestilence,
 all other customary diseases are hushed, and if by

(s) Sect. 1. c. 2. p. 5.

chance one or another makes its appearance, it always terminates in the plague. We read this in *Thucydides* (t) where he describes the plague at Athens with which he was himself seized, but luckily recovered. He also makes the following remark: *Jam vero corpus nullum visum est adversus morbum sufficere, quod ad robur, aut ad debilitatem, attinet, sed sublata sunt omnia, quavis etiam vivendi ratione ad curationem uterentur.* “But now no constitution was proof against the disease, which attacked both the strong and feeble, and carried off all, whatever way of living was used in hopes of assisting the cure.” We read the like of the plague which raged at Constantinople in the year 543 (u). From all which circumstances, if rightly considered, it must manifestly appear that the original cause and essence of epidemics cannot be deduced from a sensible vice of the six non-naturals.

S E C T. MCCCCVII.

AN D yet because of the attack being general, the possibility of escaping the disease, and of excluding the infection by wind or fire, it is judged to reside in the air.

Since, therefore, epidemic diseases were wont to afflict great numbers at the same time, though they pursued a different course of living, hence physicians justly sought the cause thereof in that which is common to all, and which no one can be without, namely in the air. Whence Hippocrates

(t) Schultz Hist. Medic. lib. 11. p. 188. (u) Friend's Hist. of Physic, part 1st. p. 143.

hath laid down (w), *Ubi vero morbus aliquis populariter grassatus fuerit, non victus rationem in causa esse, sed quod spirando ducimus, manifestum est, illudque morbosam quandam excretionem plane obtinere.* “That
 “ when any disease spreads generally, it is evident
 “ that the mode of living is not the cause, but
 “ what we imbibe in breathing, which clearly re-
 “ tains some morbid quality.” Wherefore as
 has been said in the preceeding paragraph, he
 would have no change made in the diet, but, *ut*
aëris quam minimum in corpus influat, isque ut max-
ime peregrinus sit, providendum, regionum loca, in
quibus morbus consistit, quoad fieri poterit permutando.
 “ to be careful to expose the body to the air as lit-
 “ tle as possible, and remove as far as convenient-
 “ ly can be done from the place where the distem-
 “ per rages.” Now as no human being can live
 without respiration, it is plain this only means,
 to avoid air replete with morbid impurities.
 Galen (x) enumerating the various causes of dis-
 eases, denies that epidemic distempers arise from
 diet, and says the cause of them resides in the
 air. *Aliis enim causis neque simul omnes occurrimus,*
neque diem integrum subjicimur; sed aër solus foris
omnes ambit, atque ab omnibus inspiratur. “ For
 “ we all neither are exposed at the same time to
 “ other causes, nor are we subject to them at all
 “ times; but the air alone surrounds us all abroad,
 “ and is taken in by all in respiration.” At pre-
 sent, by unanimous consent physicians allow, that
 the cause of epidemics exists in the air.

This opinion is further confirmed by the possi-
 bility of escaping the infection. For those who
 upon the first rumour of an approaching pesti-
 lence, have removed, and lived at a distance

(w) De Natura Homin. text. iv. chart. tom. 111. p. 132.

(x) Comment. 1 in lib. 1. Epidemic. chart. tom. ix. p. 2.

from the infected place, have remained perfectly healthy, as has been remarked. Moreover observations have taught us, that those who have shut themselves up in their houses, secluded from all intercourse with mankind, have continued free from the plague. Many such cases may be read of (y) where persons having first taken care to lay in a stock of all kinds of necessaries, and then shut themselves up in their houses closely, so as not to be heard of at all during the whole time the plague raged; upon the ceasing of the epidemic disease, not one out of these families has been found missing. When the plague in the years 1718 and 1719, raged so violently in the city of Aleppo, that eighty thousand persons died in the space of six months, the English families, who confined themselves in their houses, escaped the infection. In like manner the colleges inhabited by the academical citizens, and monasteries, in general remained free from the distemper. At other times also, when the plague has raged in Aleppo, the Europeans confined to their houses, and abstaining from all intercourse with the other inhabitants have lived exempt from the plague, while the Mahometans, believing in predestination, a tenet of their religion, and taking no precautions, perished in crowds. The more prudent, however, under pretence of a religious pilgrimage, namely, of visiting the tomb of Mahomet, withdraw themselves from the danger of infection. Some of them are of opinion, that Europeans from a certain peculiar idiosyncrasy, are less liable to be infected by the plague, but it is certain from observations and experience, that the native inhabitants of these countries if they remain shut up with the Europeans, reap the same advantage that they do;

(y) Lobb on the Plague, p. 45, &c.

and on the other hand, Europeans, if they neglect this precaution, have recourse to it too late, or appear publicly before the plague has entirely ceased, are equally infected as others. But the cautions which are made use of with success, to escape the contagion of the plague may be read (z).

Indeed what we read in the same author is true, that Europeans thus secluded from society, in the evening, upon the leads of their houses, which are flat, converse with their neighbours, who have taken the same precaution, and even hold conversation together from the windows (a). And therefore it should seem that the contagion of the plague does not reside in the air, seeing that such recluses, dwelling in an infected city, breathe the same air as the other inhabitants, and their whole bodies are bathed in the infected air, yet are not infected.

But it is to be considered, that this conversation is only held from the upper story of their houses; and therefore the contagion exhaling from the bodies of persons infected with the plague, being dispersed through the whole atmosphere, and as it were diluted by all the inferior air, is thus rendered inert. It is a known fact, that the most violent poison diluted in a large quantity of water, becomes harmless. The poison of the plague therefore seems to be more especially noxious, where included in small compass, and in a large quantity; far less dangerous, where diluted, and in small quantity. This opinion is confirmed by numerous experiments: when deep wells are dug, or opened after having been long closed up, there frequently exists in this confined air so deleterious a poison, that it kills in an instant, the persons who are so im-

(z) Ruffel's Natural History of Aleppo, p. 250, 262.

(a) Lobb on the Plague, p. 45.

prudent, as to go down into such wells. But when an handgranado being thrown in, the air contained in such wells is suddenly and forcibly agitated by the explosion, all danger is at an end, nor do the neighbours receive the least injury from the exploded air. When merchandize brought from infected ports is purified in places destined for that purpose, the bundles are opened, the goods contained therein are taken out, are frequently and long exposed to the air, that all the contagious particles may fly away into the air, and being mixed and diluted in the immense ocean of the atmosphere, may be rendered inert. For unless this were the case, the contagion of the plague would be diffused far and wide, by this very purifying of the goods brought from suspected places. Whence the author just cited, justly concludes, (*b*) that the contagion exhaling from a body infected with the plague, when diffused in the air, is so diluted in a short space of time, as to lose its virulent quality. Whence he also concludes (*c*) that it is not necessary to build hospitals for the reception of persons infected with the plague, at the distance of three or four miles from a city, but that a much less distance is sufficient for the public security, and conveniency of the sick.

But he considers all infected patients as so many springs from which the contagion exhales (*d*), which therefore will reside more plentifully in the air nearest the patient, and in a place far distant, will be so diluted, as no longer to be capable of doing mischief.

Whence also it is understood, that the number of patients increasing, the quantity of infection may be so increased, as to load the air more fully, and thus from the contagious fomes render it in-

(*b*) Ibid. p. 44. (*c*) Ibid. p. 46. (*d*) Ibid. p. 42.

fectious to a greater distance. This especially will happen, when the contagious particles are not immediately diffused equally through the air, but remain collected in some particular part of the atmosphere, or when before dispersed, they afterwards are collected. We know that the air in serene, warm, dry weather, contains plenty of water, but dispersed. Concentrated oil of vitriol, called frozen, alkaline salts calcined with a fierce fire, sal armoniac, sea salt, &c. prove this fact; all which exposed to the air, though even warm and dry, grow moist, and encrease in their weight. Yet in such serene warm air, no water appears. But if this water, before equally dispersed, be collected together into clouds, the serenity of the air is disturbed, and it falls under the appearance of rain, snow, or hail. If the clouds collected in the atmosphere, though thick and black, are by degrees again separated, upon their disappearance, fine weather returns, without the fall of rain, hail, or snow. It is therefore certain, that many things may be thus collected in the air, and when collected, be again diffused, and disappear. If contagion dispersed in the air, should adhere to the watery particles in the air, and therewith be collected into clouds, what before, when dispersed, was judged to be inert, might in this state prove again noxious.

Practical observations seem to confirm this. *Chirurgus, fide dignus, se in locis infectis nullas aves obvolitantes observasse, testabatur; ipsis autem usque supernataisse nebulam, etiam sereno celo* (e). “A
 “surgeon of character declares, that in infected
 “places he has observed no birds fly about; but
 “that a small cloud hung over the place even in
 “fine weather.” Sed et ipse auctor, *Medio mense*

(e) Schreiber de Pestilentia, &c. p. 6.

Septembri, ipsa meridie, dum omnino sudum esset, ingressus est oppidulum, per tres menses clausum; in quo conspexit adolescentem, modo mortuum, cum carbunculo; atque, similem notavit nubeculam. Hanc semper adfuisse, et incolæ, et custodes, testati sunt. “ And
 “ the author himself, in the middle of September,
 “ at noon, when it was fine weather, went to a
 “ town which had been shut up three months, in
 “ which he saw a youth just dead of a carbuncle,
 “ and remarked a like cloud. That this was al-
 “ ways there, both the inhabitants and the guards
 “ affirmed (f).” It seems extremely probable
 that the contagion collected in such a cloud ho-
 vered over this town, which by chance dispersed
 in the air, was rendered inert, and collected again
 in a place at some distance, became again conta-
 gious. *Nonnulla enim loca paludosa, infectis locis
 propinqua, impune incolebantur; contra fuerant loca,
 ab infectis magno intervallo remota, ut et in alto con-
 stituta, quæ eadem vexabat ægritudo, intermediis sa-
 nissimis.* “ For some marshy places near those
 “ infected were inhabited with safety; on the
 “ contrary there were places at a great distance
 “ from the infected ones, and also situated on
 “ high ground, which were afflicted with the same
 “ distemper, though the intermediate parts con-
 “ tinued perfectly healthy.” The celebrated Sor-
 bait, formerly professor in the university of Vien-
 na, and first physician to his imperial majesty,
 says, (g) that in the time of the plague several
 bluish, fiery balls were seen in the air: nay, that
 upon the twentieth day of October, about twi-
 light, several such balls fell; which heated the
 air to such a degree, that persons looking out of
 window seemed to him, as if they had put their

(f) Ibid. p. 6. (g) Consil. Medic. de Peste Viennæ, p. 137,
 140.

heads into a warm stove, which continued till late at night. A lighted candle being placed near dying persons, a very livid vapour was seen to issue from their mouths. A pious clergyman, whose duty it was every day to visit the infected, remarked the circumstances he observed among the sick; and declares, *multoties quasi fumum caeruleum in ejusmodi infectis hypocaustis observasse, ubi infirmi continebantur; quare, apertis fenestris, per ludimoderatorem, pulverem nitratum subito, in charta contentum, accendi fecit; quo auram illam caeruleam, et consequenter venenosam supra modum, per fenestrelas apertas expulit* (g). “ That he frequently observed as it were a blue smoak in the rooms where the infected lay; on which account, the windows being thrown open, he caused some gunpowder, inclosed in cartridge paper, to be fired; whereby that blue and consequently highly infectious vapour, was expelled through the windows.” Being himself afterwards seized with the plague, and having taken some physic he brought up by vomit nothing but a foetid, bluish fluid, the stench of which infected one of his servants, who instantly sickened, and was cured by taking emetic tartar.

All these circumstances seem to prove, that the miasmata, which produce epidemic disorders, reside in the air, and they sometimes show themselves by other signs. Thus in the plague of Oczacow, it was observed, that, (b) *instrumenta, quibus chirurgus usus erat, adeo livida et atra fuerint reddita, quasi aqua forti imbuta essent. Quin imo, capulum argenteum gladii, qui, per omne tempus pestis, tentorio adfixus fuerat, nigrescens factus fuit.* “ The instruments which the surgeon made use of were

(g) *Æsopus Epulans, &c.* p. 413, 415. (b) *Schreiber de Pestilentia*, p. 75.

“ turned as black and livid, as if they had been
“ dipped in aqua fortis. And the silver hilt of a
“ sword, which all the time of the plague hung
“ up in a tent, was changed quite black.”

This contagion residing in the air, birds seem to be sensible of and to avoid, which frequently fly about in times of no pestilence, as has been just observed. Sorbait confirms this by his own observations (*i*), and remarks, that larks, so numerous in Austria, during the autumn season, were wholly wanting, so that not a single one could be met with: tame birds kept in cages all died. Besides he observed, that three times the number of infected persons died in wet weather, than when the weather was fair and dry. For the contagion exhaling from so many infected persons, is far more difficultly and slowly dispersed through the atmosphere in damp weather; as may be observed in the smoke ascending from chimnies. When therefore the circumjacent air is full of these impurities, nor are they dispersed through the circuit of the atmosphere, but remain collected, and brood long over the infected place, then the number of sick increases. Besides at such seasons, human bodies absorb the moisture from the contiguous air: for that the whole superficies of the human body, both internal and external, inhales as well as exhales, Kau (*k*) has demonstrated. And at present we know, taught by the experiments of the celebrated Dr. Hales, that the air itself enters the body in great quantity, and is united very intimately with the solid and fluid parts, even in old people; for instance, the horns of deer contain a great quantity of air, which may be extricated by a chymical process. Hippocrates therefore (*l*)

(*i*) Confil. Med. de Peste, p. 34, 36. (*k*) Perspirat. Diæt. Hippocrat, &c. p. 184, &c. (*l*) De flatibus, cap. 2. chart. tom. vi, p. 214.

hath with truth affirmed, *Hominum et reliquorum animantium, corpora triplici alimento nutriuntur; quorum hæc sunt nomina: cibus, potus, spiritus.*

“ The bodies of men, and other living creatures
“ are nourished by a threefold aliment, viz, meat,
“ drink, and spirit.” What Hippocrates meant

by spirit appears from these words which immediately follow that text: *ac spiritus quidem, qui in corporibus sunt, flatus nominantur; qui vero extra corpora, aer. Qui quum maximus in omnibus, qua corpori accidunt, auctor et dominus sit, dignum ergo videtur, illius potentiam inspicere, &c. Quid enim sine hoc fit tandem? aut a quonam hic abest? aut cui non præsens est?* “ But the air in bodies is called

“ wind; that without the body, air. Which since

“ it is the chief author or prevailing cause of what-

“ ever happens to the body, it seems worth while

“ to examine its power, &c. For what, at length,

“ is done without it? or in what is it wanting? or

“ where is it not present?” After having expatiated

on the subject, at length Hippocrates concludes (m),

Morbos unquam vix aliunde, quam ab aere orire posse, quum is, aut copiosior, aut parcius, aut etiam plenior, aut et morbidis inquinamentis infectus, in corpus subierit.

“ Diseases can hardly ever proceed from any other

“ cause than the air, since either stronger or weak-

“ er, or heavier, or lighter, or infected with

“ morbid impurities, it invades the body.” Be-

cause therefore air may both reside in our fluids, and

firmly unite with our solids, we readily understand,

how the contagion inherent in the air, can there-

with penetrate through every part, and disorder

the whole body. Besides the inhaling veins readily

admit the aqueous particles resident in the air as

static experiments prove; for bodies in a moist air

(m) Ibid. p. 215.

weigh more heavy; hence, not only from the exhalation being lessened, but also from the inhalation being increased, morbid impurities seem capable of penetrating into the body, and injuring health.

This seems chiefly to be apprehended, if the air thus contaminated, agitated by no brisk winds, should continue long hovering over the same place, as has been said just before, to have been observed in cities where the plague raged. And the same has been remarked in other epidemic diseases. Forestus (n) describes the epidemic sore throat which suddenly began to spread itself in October, 1557, seizing whole families in Alcmár, and in two or three weeks carried off above two hundred persons. *Hic morbus tanquam flatu quodam oriebatur, cum nebulae densae, maleque olentes, per aliquot dies prius præcessissent, adeo subito irrepens, ut mille mortales uno fere momento invaserit.* “This disease arose as it were from a certain vapour, since thick clouds of an ill smell preceded it for some days, breaking out so suddenly, that it seized almost instantly a thousand persons.” This distemper, which he calls a malignant catarrh, he hath accurately described, and under which he acknowledges he laboured himself. The origin of this epidemic disease, was not without reason ascribed to the ill smelling cloud which for some days hung over the city of Alcmár. Hence appears the reason, why from brisk gales physicians often entertain hopes of the amendment of infectious air; since by this means the contagion may be blown away, which remains collected in the air; of which we shall next speak.

(n) Lib. vi. Observation. 1 tom. 1. p. 188.

By wind.] Lord Verulam hath laid down the following axiom; (o) “ Wind is not any thing “ different from air in motion, but air itself in a “ state of motion.” But air in motion carries along with it every thing which it contains. For wind is, as Hippocrates has observed “ a flux and reflux of the air ” (p). *Aeris fluxus et effusio*. Hence the celebrated Hoffman hath informed us (q) *nulum ventum per se singulari et specifica qualitate, ac virtute pollere, nisi quæ a loci, unde oritur, natura, nec non medii, per quod transit, indole, derivanda sit*. “ That no wind possesses of itself any particular “ and specific quality or virtue, except what may be “ derived from the nature of the place whence it “ comes, and the medium through which it “ passes.” In which opinion he is joined by Hippocrates, (r) who treating of winds lays down the following observations: *Verum propter situm regionum et locorum, per quæ ad regiones quasque accedunt, inter se differunt, et frigidiores, calidiores, humidiores, sicciores, morbosiores, et salubriores, existunt*. “ But “ on account of the situation of the regions and “ places through which they pass to some countries, they differ from each other, and are colder, hotter, moister, drier, unhealthier, or “ healthier.” For hence depend the different effects of the same wind in different parts. Thus Lord Verulam says (s), “ the south wind with us (the “ English) is rainy, in Africa brings fair weather, “ but great heats, not cold as many have asserted. “ Yet it is healthy enough in Africa. But with “ us it is very pestiferous, if the wind remains “ long in the south quarter without rain.” By the wind therefore, that is, by air in motion, an

(o) Bacon. Hist. of Wind, p. 497. (p) Lib. de flatibus. ch. 2. chart. tom. vi. p. 214. (q) Opuscul. Medic. tom. 1. p. 27. (r) de Victu Acutor. lib. 2. c. 2. ch. tom. vi. p. 464. (s) Hist. Vent. p. 450.

infinity of small particles may be carried from one place to another, and indeed to a very distant part. For whatever, on the whole superficies of the earth, exhales from living or dead animals, vegetables, or minerals, naturally or by art, the whole is diffused in the air, and the whole may be dispersed on every side by the motion of the air. What the celebrated Boerhaave has wrote concerning this subject deserves to be read with attention (*t*).

Whence it seems that winds may do service, and prove prejudicial. They will do service, if they blow away this noxious matter, the cause of epidemics, and disperse it through the whole atmosphere in such a manner, that divided by great space, it can do less mischief, or is wholly rendered inert, as has been already observed. They will do mischief, if they carry from one place to another, this noxious matter, not in a dispersed, but remaining in a collected state. The epidemic distemper indeed decreases in the place where it first raged; but it will be communicated to another place, where it is carried by the air; unless in its process through the ocean of the atmosphere, it is so diluted, as to be less capable of infecting, or by any other means be rendered inert. Medical observations prove the possibility of either event.

Mean while this good may always be expected from the wind; that by the motion of the air the epidemic virus will decrease in the place where it rages, and those particles, which reside in the air, obnoxious to putrefaction, will not so easily become putrid in air in motion, as in air in a quiescent state, especially if heat and moisture act in conjunction therewith, which, it is well known, highly promote putrefaction (*u*).

(*t*) Chemistry. tom. 1. p. 478, &c. (*u*) Chem. tom. 1. p. 483.

The first inhabitants of America, who resided in places closely planted with forest trees, died of a malignant distemper, that very quickly dissolved the juices of the body, a kind of putrid fever. For as it appears from the observations of the celebrated Hales, that a great quantity of water is dispersed in the air by the leaves of plants, and especially of large trees, the air must necessarily be moist in such places, while at the same time the climate is very hot; which two circumstances conjoined, greatly favour putrefaction. But after the trees were all lopped, and burnt, the fresh air gained a free admittance through this country, and those bad diseases disappeared (*w*). Mead has proved the justice of this observation, from the natural history of various countries (*x*).

Hence Sanctorius has asserted (*y*) *Radii pestis vento loco dimoventur, corporis lucidi nulla vi*. “The rays of the plague may be removed from their place by the wind, without the power of a lucid body.” For he was of opinion, that from an infected house, as from a centre, the contagious rays diverged in every direction: at the same time he was astonished that the rays emitted every way from a lucid body, were never disturbed by the force of the air. Degner from attentive observation informs us, that the first house, in which a person died of a dysentery, became as it were a centre, from whence the distemper spread over the whole circumference of the city (*z*). He moreover observes, that in the particular place where the distemper first made its appearance, it raged with most violence during the whole of its progress, and that a great

(*w*) Ibid. p. 620, 621. (*x*) De Peste, p. 8: (*y*) Gorter de perspirat. p. 212. (*z*) De dysenteria, etc. p. 4. etc.

many more were seized with the disorder there, than in any other parts of the city, where this contagious disease was gradually propagated. These instances strongly confirm the opinion of Sanctorius.

It therefore appears that these morbid rays may be dissipated by the wind, which is also confirmed by medical observations. In Austria, frequent, sudden, and often high winds, are observed, which the inhabitants judge so healthy, that it is a common proverb; Austria is windy, without wind it is unwholesome.

Sorbait (*a*) hath observed, that at the time of the plague of Vienna, the wind did not blow for three whole months; but after the obstacles being removed, it had regained its pristine liberty, it set in motion the torpid air, and the stench, before troublesome, was almost wholly dissipated, with a manifest alleviation of the distemper. The very accurate observer of epidemic diseases, Huxham (*b*), declares, that he frequently observed epidemic diseases much lessened after storms and hard rains: “the contagious effluvia, and morbid congestions of the atmosphere being by these means dispersed.” He at the same time justly remarks, that Augustus built and consecrated a temple to Circius, a most violent wind, and that the Gauls formerly returned public thanks to this very tempestuous wind, though it frequently blew down their houses; as to what they were indebted for the healthiness of their climate. See also what is said at § 605 no. 4, concerning the correction of acrimonious and putrescent air. We read in Forestus (*c*), that the English sweating sickness invaded the city of Amsterdam the

(*a*) Confil. de peste Viennæ, p. 144. (*b*) De aere et morbis epidem. p. 4. (*c*) Tom. 1, lib. vi. p. 198.

27th of September, 1529, but raged there only three or four days: *nam, post quintum diem ad alia loca celeritate quadam transvolabat, neque amplius in urbe visus est.* “ For at the expiration of the “ fifth day, it passed with a certain celerity to “ other parts, nor was more seen in the city.” Whether or not, did the contagion, carried by the winds to other places, free the infected city? It seems extremely probable that this was the case. Forestus did not see this disease himself, being at that time but a child.

That the cause of epidemic diseases is capable of being borne from place to place by the wind, has been noticed § 605, 4; where it has been said, that Empedocles prevented a pestilential distemper, by closing up a cavity of a mountain from whence an unwholesome south wind issued. Caius, an Englishman, has observed, that some thick clouds, and stinking unwholesome fogs brought by the wind from the county of Salop, spread this epidemic disease over all England. (d) *Nam a primo suo ortu & fœtor gravis malum prodebat, & visus est veluti nimbus de loco in locum gubernantibus ventis se promovere, & nimbi vestigia pestem hanc secutam esse observatum est.* “ For from “ its first origin, both a violent noisome smell “ preceeded the distemper, and a black cloud “ was seen to move from place to place, as “ it were at the pleasure of the wind, and the “ pestilential disorder was observed to follow exactly the rout of the black cloud.” When a large fish of the whale kind, of immense bulk, ran ashore on the Dutch coast, nor could again reach the sea notwithstanding its utmost efforts, and at length died on the sands: among the numerous spectators, who ran thither from every

(d) De Ephemer. Britan. p. 34, 38.

part, Forestus himself was present (*e*). The neighbouring inhabitants not being able to remove the dead fish on account of its prodigious size, and neglecting immediately to divide the carcase into small pieces, the whole putrefied, and infected the country with an horrid rancid stench, in consequence of which a pestilential fever broke out in the district of Egmont, and the adjacent parts, that carried off great numbers. It may readily be conceived that the wind blowing from this place, might have carried these highly putrid miasmata to other parts with the like effect.

These circumstances shew plainly what may be hoped for, and be feared from the wind, in epidemic constitutions of the air.

By fire.] All philosophers who have diligently examined the nature of fire, have been astonished at its wonderful properties: it enters all bodies, acts in their inmost recesses, separates mixtures, unites distinct bodies, penetrates through every thing, and is present every where. Whence chemists have proudly called themselves philosophers of Fire. It is no wonder therefore, that physicians have also thought of purifying the air by fire, when they were of opinion that such particles were contained therein as might prove noxious to mankind. The old adepts saw all vegetable and animal substances destroyed by a strong fire; and knew that even fossils might be destroyed by an intense heat, so as to be entirely dissipated into the air, or be vitrified. They also saw, that those substances which were evaporated by a strong fire, if the operation was performed in a close stopped vessel, afforded very similar products,

(*e*) Lib. vi. Observ. 9. tom. I p. 202.

though they were separated from very different plants; and therefore with reason concluded that the distinguishing characteristic of each was thus destroyed, or underwent an extraordinary change. Hence they were in hopes that the contagion inherent in the air, the cause of epidemic diseases, might be so changed by means of fire, as to lose its noxious quality. From what has been said at § 605. No. 4. it appears, that not only Hippocrates made this experiment, but also long before Hippocrates, physicians were of opinion, that the air might be purified and cleared of its noxious qualities by fire. It is true indeed, that according to the different fuel with which a fire once kindled is kept up, a different effect may be produced, as the vapours raised by the fire from this fuel are dispersed through the infected air: but we shall speak further of this matter in the following paragraph. In this place we are only treating of fire, as far as it destroys, changes, or even dissipates the noxious qualities inherent in the air; whence we shall next consider what faithful observations have taught us concerning the efficacy of fire for this purpose.

Fire certainly increases the action of many bodies; hence, unless this noxious quality which resides in the air could absolutely be destroyed by fire, or be dispersed elsewhere, there is reason to fear, lest its activity may be augmented by fire. The celebrated Mead (*f*) though he acknowledged, nay knew for certain, that some morbid affections of the air proceeding from bad exhalations of the earth, might be corrected and wholly removed by fire, was yet apprehensive, lest after the distemper had once broke out, the

mischief should be increased through fire. In the last plague the event proved fatal: "For, fires having been kept burning in all the streets for three days together, in the following night not fewer than 4000 persons died, while for the three or four last weeks not above three times that number had been carried off in the whole."

In the twenty-first year of the present century, a terrible plague laid waste the city of Toulon for the space of ten months; so that almost two-thirds of the inhabitants were carried off by this terrible distemper. A gentleman who acted as chief magistrate, during the whole time of the plague, in that city, has given an exact account of every thing that was done to destroy the contagion, and candidly relates the success of the different experiments. Some insisted, that by burning large fires, the air might be purified, and the pestilence dissipated: upon searching the public records, it was found that the same method had been taken formerly when the plague raged in that city; but no mention was made of the success of the experiment. Yet as the inhabitants in general were desirous of having the experiment tried, nay insisted upon it as the last anchor of the public safety, the magistracy ordered wood to be laid before every house at three o'clock in the afternoon, and at seven o'clock in the evening, upon the ringing of the town bell, all the fires were to be lighted together. This was precisely executed, and from this general fire, the whole city was so covered with a thick smoke, that it was not wholly dissipated even the next day. But it had no perceivable good effect, for the plague raged as violently as before. Whence this worthy man (g) warns his

(g) Antrechaus's Account of the Plague at Toulon, ch. 22. pag, 148.

fellow citizens not to make the like experiment in future, at such an expence of wood, and aromatic plants, (for they also were made use of.)

Nay Erndtelius (*b*), first physician to the king of Poland, from the accounts of others, creditable persons however, relates, that the plague, which from the first of May to the last day of October, carried off about twenty thousand persons, was much exasperated by a great fire which broke out by accident in the suburbs of Warsaw, on the first day of July, when the plague had almost ceased. He remarks, however, that the more sagacious attributed the increase of the pestilence, not to the fire, but rather to the terror with which this shocking fire struck the inhabitants.

These observations have caused physicians to expect less since from the efficacy of fire, in subduing the plague, some fear, lest the disorder should be increased thereby; others only judge this method ineffectual (*i*). For while the air which freely passes every where, is like the former that before encompassed the city afflicted with the plague, it seems from hence, that much benefit cannot be expected from fires burning in the open air. Indeed, it is probable, that the noxious quality inherent in the air might be destroyed, if all the contaminated air could be forced to pass through the fire: but this destroying power of fire seems only to act on the proximate air, and wholly to cease in the more distant region of the air. Since therefore, the action of fire is capable of augmenting the activity of many things, in the plagues of London and Warsaw the number of the dead was greater after the fires, in the other observations it was tried without the least ad-

(*b*) Warsaw. Phys. illustrata. ch. v. p. 171. (*i*) Lobb on the Plague, p. 54, 55.

vantage accruing, what is to be thought on this matter is apparent.

Nor does what has been said at § 605. 4. contradict this opinion; for from thence it appears, that odoriferous woods were used by the Antients, (concerning which we shall speak in a future paragraph) and that the physician Acron, more ancient than Hippocrates, "burnt fires by his patient's bedside, and by that means many received benefit." For a widely different effect might be expected from fire, if burnt in an infected house, than when made in the open air.

The celebrated Lobb has excellently treated this subject, and made a proper distinction (*k*). He expects great things from it, if made on an hearth under an open chimney, in the room where the patient lies; for in this case the air is put into perpetual motion, and being rarified by the fire, fresh air makes its way to the chimney, and for the most part passes through the fire, before, making its exit through the top of the chimney, it is dissipated in the atmosphere. But he advises, that the same be done in all the other rooms in the house: for unless this be done, in one chimney the air rushes through the tube from the lower parts upwards, while in the rest of the chimneys the air is drawn from the upper parts downwards, to restore the equilibrium of the air. That the foetidness of the air, so offensive and troublesome to variolous patients, is removed by this means, the famous physician Mortimer experienced himself, when seized with the small pox in the month of June: he directed a wood fire to be kept burning day and night, that there might be a constant succession of fresh air; but in the daytime he was careful the chamber should not be too much heated by the fire, by keeping the doors and windows constantly open: thus the air, infect-

(*k*) Ibid. p. 10, 20. 43, &c. (*l*) Ibid. p. 10. (*m*) Ibid.

ed with the variolous contagion, was purified by the fire, in its passage through the chimney to the atmosphere, through which it was diffused. For Lobb thought, that these miasmata were rendered inert, when dispersed through any distance in the atmosphere.

Mean while it is to be remarked, that the variolous contagion in this passage through the fire is not immediately rendered entirely inert. It seems probable, that the air, which is compelled to pass directly through the flame of the fire, is purified from this contagion; but that, which passing on both sides of the fire, makes it escape up the chimney, seems to retain its contagious miasmata, till mixed with the atmosphere; though afterwards by a greater dilution, it may be rendered inert. Mortimer observes, that the house contiguous to that where he lay ill of the small pox, which was next the chimney through which the air was renewed in his bed-chamber, was affected with the small pox, while the next door on the other side, more distant from his chimney, continued uninfected. Whence it appears, that the whole contagion is not always destroyed by the fire and smoak, but part of it remains unchanged in the air, which by a further dilution in the atmosphere seems to be rendered inert, since it did not infect the house that was at a distance from the chimney.

But this easy dispersion, and as it were dilution in the air, does not always equally take place. For we see, in cloudy, warm, damp, still weather, the smoak either ascend not at all, or with difficulty, from the tops of chimneys, and frequently when it first rises from the chimney, it remains suspended in the atmosphere, and hangs some time over the mouth of the chimney as if motionless, with great inconvenience, the whole house being then filled with smoak. Such a disposition of the air seems

seems to have existed at the time of the plague of Vienna, when for three whole months, as has been observed, there was a constant calm. In like manner it is remarked in the description of the plague which raged at Toulon, that the smোক, arising from the fires kindled throughout the whole city, was not dispersed through the atmosphere even the day after; and perhaps this was the reason, the plague was no ways abated by the fires burnt throughout the whole city.

But as it appears from fatal instances, that the contagion of the plague is capable of adhering a long while to beds and other things contiguous to the bodies of the infected, it is evident, why able physicians have been apprehensive, lest, by the burning of these things in the time of a plague, the contagion should thereby be spread the wider. Erndtelius (*n*) has remarked, that a whole year after the pestilence had ceased, when accompanying the court of Poland, he passed through Warsaw, several persons died there of the plague. This misfortune arose from the wife of a waggoner, very big with child, who to enable herself to lie in more comfortably, had pilfered some pillows, that had been used a twelve-month before by persons who had died of the plague. The poor wretch, using these, was presently taken ill; the day following buboes appeared in her groins; soon after she was happily delivered; but a violent hæmorrhage from the womb coming on, carried her off, and the child died also. In a few days the husband was seized with the same disease, carbuncles and buboes struck out upon him, and he met the same fate: and as several others were infected, it was found necessary to separate the infected from the healthy. This being put in execution, at the end of four

(*n*) Warsaw. Physic. illustrata, ch. v. p. 171. 172.

months the distemper ceased without making further havock, than destroying about twenty persons; especially because guards were placed in the neighbouring districts, and by that means the contagious distemper could more easily be prevented from spreading.

Whence it is customary to burn beds, quilts, blankets, *etc.*; but, unless the contagion in these utensils be destroyed by the fire, or dispersed in the air so as to become inert, many have apprehended a propagation of the infection. Sorbait (*o*) who was an eye-witness of the plague of Vienna in 1679, and has given an accurate description of it, speaking about burning of beds, makes the following observation: *Quando hæc comburuntur, vento in contrarium non flante, perniciosissimum spargitur miasma per urbem, & ejus compita; dissuasi persæpe horum combustionem, præcipue flante vento, consuluique potius, ut effossis foveis inhumarentur, vel saltem, tempore, tempestate, & loco debitis, concremarentur; sed nihil effeci; adeoque hoc cum cæteris erroribus transire debuit.*

“ When these are burnt, the wind not blowing
 “ the contrary way, a most pernicious miasma is
 “ diffused through the city and its environs; I
 “ have frequently dissuaded the burning of these,
 “ especially in windy weather, and have advised,
 “ that they should be buried deep under ground,
 “ or only burnt at a proper time, weather and
 “ place; but I have not been able to pre-
 “ vail; and therefore this has gone on with
 “ other vulgar errors.” What the celebrated Lobb has said on this subject deserves an attentive perusal (*p*), who likewise entertains great apprehensions from the burning of furniture, *etc.*

(*o*) Confil. Medic. de Peste Viennæ, p. 52. (*p*) Of the Plague, p. 356, and the following pages.

unless it is done in places remote from inhabitants, and the wind in such a corner as to drive the smoke of the burnt goods from the inhabited places and public roads. But as the direction of the wind is often suddenly changed, and this alteration cannot be foreseen, he is of opinion that the burning of infected goods is always a matter of great uncertainty, with respect to the consequences. He judges it far safer, to sink infected ships in the sea at a great distance from shore, and to bury very deep in the earth, bedding, cloaths, furniture, *etc.* having been first rendered unfit for use, by being sprinkled with quicklime, aqua fortis, or oil of vitriol, lest perhaps avarice should incite any one to dig them up, and thus the contagion be spread abroad a second time.

(*q*) He at the same time relates, that the cloaths of a variolous patient, when that distemper was rife, were burnt to destroy the infection; which succeeded extremely well in the house where the infection was, and even in the adjacent ones. But the wind drove the smoke of the burnt things towards the opposite row of houses, in which a sudden and surprising variolous infection was observed to make its appearance. Thus it is confirmed, that all the contagion is not destroyed by fire, but may be dispersed in its whole virulence. The celebrated Mead (*r*) indeed orders the cloaths to be burnt; for he was extremely solicitous about destroying the apparel and furniture of the infected patient; but as that may be obtained, as has been mentioned, by a safer method, the thing is the same. Indeed he proves from Boccace's account of the plague at Florence, which raged in 1348, that the most viru-

(*q*) Of the Plague, p. 360. (*r*) Ibid. p. 21.

lent contagion may adhere to cloaths. For he saw “ with his own eyes two hogs, that had rolled
 “ about with their snouts, and gnawed some pieces
 “ of bread, which had been thrown into the street
 “ from a poor man’s house who died of the
 “ plague, instantly seized with convulsions, and
 “ die within an hour after.”

Besides the destruction of the contagion by fire, physicians have entertained great hopes, that the contagion remaining collected in one particular place, might be suddenly dispersed through the atmosphere; and by this means, as has been mentioned, be either rendered altogether innocent, or at least, less noxious! And as gunpowder produces a great explosion when fired, and impells the neighbouring air in every direction, it has for this reason been justly recommended for this purpose. We read in history, (s) that the plague which raged in a besieged city, immediately ceased, upon the powder magazine which contained a large quantity of gunpowder, being blown up by accident, the violence of the explosion being so great as to beat down the neighbouring houses, damage the city walls, and kill many persons. We have already taken notice at § 605. 4. of the remarkable efficacy of sulphur in purifying the air, contaminated with noxious effluvia, and there recommended gunpowder, the smoak of which when fired, is easily borne by mankind, when on the contrary, sulphur burnt alone, emits a suffocating vapour.

Therefore although gunpowder may also do service by its smoak, yet it is likely, that its sudden violent explosion conduced greatly to destroy instantly the plague in the besieged city.

(s) *Vaderlandsche Historie*, tom. ix. lib. 33, pag. 30, 31.
 (t) *Lobb on the Plague*, pag. 62, 63.

Gunpowder also, mixed with camphor and other aromatics, may when fired, suddenly diffuse their grateful fragrancý through the atmosphere, (*t*), that this is not an useless circumstance will appear in the sequel.

S E C T. MCCCCVIII.

AND in it rather for the inexplicable variety of exhalations, which by way of mixture or stimulus disorder our machine, than for the remarkable change of the sensible qualities, as observation teaches.

What has been already said sufficiently proves, that the cause of epidemics is to be sought for in the air. But to ascertain what that is in the air, which does this mischief, is a matter of very great difficulty. Indeed a remarkable change in the air, obvious to the senses, is observed at different seasons of the year, and from other causes, so that it is hot, cold, moist, dry, heavier and lighter, at different times, and it is absolutely certain, that the solids and fluids of our bodies are affected by these sensible qualities of the circum-ambient air, and more or less disposed to this or that disease thereby; all which circumstances the celebrated Boerhaave has enumerated in his treatise on the causes of diseases (*u*) but at the same time he carefully instructs us (*w*); that *Cælum, annit tempestas, solum, mare, lacus, paludes, flumina, vapores, exhalationes, meteora, aërem ita permutant, ut creët varios morbos, non pendentes adeo ex ipsa aëris indole, ejusve dotibus, qualitati-*

(*t*) Lobb on the Plague, p. 62, 63. (*u*) Institut. Medic, 746, etc. (*w*) Ibid. 752.

busque, quam quidem ex natura & efficacia admisti: unde etiam inde inquire, atque intelligi, debent. “ The
 “ weather, climate, season of the year, soil, the sea,
 “ lakes, marshes, rivers, vapours, exhalations, and
 “ meteors, induce such a change in the air as to ren-
 “ der it capable of creating various diseases, not de-
 “ pending therefore on the natural constitution of
 “ the air, or its properties or qualities, but on the
 “ nature and efficacy of the mixed substance :
 “ whence also they ought to be sought for, and dis-
 “ covered there.” And therefore although the
 qualities of the air are by no means to be neg-
 lected by a physician when he is considering
 diseases, yet they do not seem sufficient to give
 us an insight into the original cause of epidemic
 diseases. Sydenham, who took so much pains
 to discover the cause of epidemic diseases, can-
 didly acknowledges, that he remarked with the
 utmost care and assiduity, the different consti-
 tutions of different years, as to the manifest qua-
 lities of the air, in hopes of finding out the causes
 of the so great vicissitude of epidemics, but that
 he had lost his labour : for he observes, “ that
 “ years perfectly agreeing as to the manifest tem-
 “ perature of the air, have nevertheless pro-
 “ duced very different tribes of diseases, and
 “ vice versa (x).” I am not therefore in the least
 surprised, that I myself have not been more for-
 tunate than so great a man, though I carefully
 remarked for ten successive years, three times
 a day, the height of the barometer, thermome-
 ter, the direction and strength of the wind, the
 quantity of rain that fell, the various changes of
 the air, diseases, number of the sick, and also
 of those who died. However I do not repent
 my labour, though I did not thereby gain the
 least knowledge of the original causes of epide-

(x) Sect. 1. ch. 11. p. 5.

mic disorders. For many diseases are allowed to derive their origin from the sensible and manifest qualities of the air, as Sydenham witnesses (y), such as pleurifies, quinsies, *etc.* which generally attack the human body from sudden heat immediately following long continued intense cold: but these diseases Sydenham calls intercurrent; which are entirely different from a reigning epidemic. Yet he observes, “that the abovementioned qualities of the air may more or less dispose the body to the particular epidemic disease.” Nor does he seem to expect this effect from the alteration of the air only: for he immediately adds, “and the same may be affirmed of any error in the non-naturals.” In another place (z) he explains still more clearly this doctrine, which is of so great importance in physic: “It should therefore be observed that, though the manifest qualities of the air may not make so strong an impression upon a particular constitution, as to be the productive causes of the epidemic diseases, which are properly referred thereto; as these arise from some latent and inexplicable disposition thereof, yet they have a power over them for a time, and hence epidemics are admitted or excluded, as the manifest qualities of the air, favour or oppose them. But the universal constitution remains precisely the same, whether these promote, or in some measure retard it.”

Repeated observations confirm this: the plague frequently disposes bodies which it seizes to sudden putrefaction, particularly when the summer heats favour putridity, especially if the air is moist at the same time, as every body knows: hence in places infected with the plague the

(y) Ibid. (z) Sect. 1111. ch. iv. p. 168.

wretched inhabitants sigh for the cold of winter, hoping therefrom a total abolition, or at least a decrease of the distemper. But the plague of London began in the month of December, 1664(*a*). The plague of Warsaw began in the month of May; and had almost ceased towards the latter end of June (*b*), but being stirred up the first day of July, by an accidental fire, it began to rage again more fiercely than at first. When the plague raged at Aleppo, and in the beginning of July the hottest season of the year came on, the disease remarkably decreased, and towards the end of the same month entirely ceased (*c*). In general it has been observed in Aleppo, that the plague always ceases in the hottest season of the year, as manifestly appears from the accounts of several years in which the plague raged (*d*). Whence it may be concluded, that the putrefactive quality in the plague is something different from putridity, which is augmented and cherished by heat.

But this matter, which is mixed with the air, is altogether different from air, and produces epidemic diseases, sometimes arises from causes sufficiently manifest. When, as has been mentioned in a preceeding paragraph, a whale of prodigious size cast on shore, putrefied, so that in a few weeks the bones only remained, all the other soft parts being so dissolved by the highest state of putrefaction, that they were evaporated into the air, every body justly attributed the pestilential disease, to these highly putrid effluvia mixed with the air in large quantity. When substances liable to putrefaction are cast on shore

(*a*) Plague no contagious Disease, p. 10. (*b*) Warsaw. Physic. illustrata, p. 171. (*c*) Russel's Natural Hist. of Aleppo, p. 192. (*d*) Ibid. p. 228, etc.

by the sea, which on the ebbing of the tide remain upon the sands, and putrefy, particularly in the summer season, the neighbouring inhabitants, with reason, attribute to this cause, the troublesome and lasting epidemic fevers, with which they are afflicted. Every body knows how noxious stagnant waters in lakes and marshes are, after extraordinary inundations; and innumerable instances are to be met with in medical writers, of the worst epidemic diseases, which arose from this cause alone, and were wholly exterminated by cleansing away the noisome filth of the stagnant waters. The excellent treatise, wrote a few years ago on this subject, deserves a reading (*e*), which demonstrates that the very worst malignant epidemic fevers have arose from this cause, and most particularly fatal to the inhabitants of the districts adjacent to these stagnant waters. Moreover, the treatise of the learned physician Tozzetti, so well known by his numerous publications, from reading which I with gratitude confess that I have learnt many particulars, concerning this same cause of epidemic diseases, may be read with great advantage; it contains every thing worth notice, that Lancisi and others have wrote on the same subject. These two excellent physicians differ indeed about the place where the greatest mischief was done by the stagnant waters, but agree concerning their bad effect (*g*). Indeed the cause of such epidemic diseases is sufficiently known, nay is easily distinguished by the senses, for example, by the foetid smell, and such diseases are observed to be increased by the hot air of summer, and to be abated by the cold of winter. This, Tozzetti, relating the

(*e*) Nenci intorno le acque stagnanti, etc. p. 53, etc. (*f*) Della insalubritate d'aria' etc. p. 97, 268, etc. (*g*) Ibid.

epidemic constitutions of different years (*b*), confirms: for they always ceased spontaneously upon the approach of winter; especially if plentiful showers of rain diluted the slime and mud collected in marshy places; for thus the mud being diluted with pure water, and at the same time the cold weather coming on, was rendered less noxious. Whence he also advises the skilful in hydraulic works, always to dig wells, hollow canals to dry up marshy places, empty drains, *etc.* towards the latter end of winter or beginning of spring, but never in the middle of spring, autumn, or summer; for he well knew that if marshy places were disturbed in warm weather, they proved highly injurious to the human constitution. He afterwards, by a great number of watchful observations, shews the utility of this caution, and the ill consequences that arise from a neglect of it. While on the contrary the plague, when the air grows hotter, frequently abates, nay wholly ceases, as has been said, which circumstance was also observed in the plague that raged at Oczacow in 1738, and 1739; for it broke out in the month of April, raged till the twelfth of June, after which day it decreased apace, and wholly ceased in the month of September; it returned again in the month of February, the following year, and was totally extinguished in the month of July (*i*).

However, although it cannot be denied that putrid exhalations are noxious, and produce epidemic disorders, yet it is no ways certain that all epidemic diseases are produced by putridity. For that latent malignancy in the air, which by way of mixture or stimulus disorders our machine, cannot always be easily reduced to any particular

(*b*) Ibid. page 108. &c. (*i*) Schreiber de pestilentia, p. 75.
known

known species of acrimony. Thus at § 1605. 4, we remarked, that those who dress the skins of animals for various uses, and those who make glue from particular parts of animals, constantly breathe an air contaminated with putrid exhalations, and yet continue healthy, though the stench is so great in places where these trades are carried on, as to prove offensive to passengers. Besides, it could by no means be hence comprehended why an epidemic disease sometimes attacks mankind, sometimes a particular species of animals; and cannot be conveyed to man, or any other species of animals, though residing together in the same house. Nay, the air replete with putrid effluvia, has been observed to prove a remedy for the plague. The celebrated Malouin (*k*) who deserves particularly to be read concerning epidemic diseases, remarks that, during the raging of the plague in the cities of Lyons and Marseilles, it was observed that the most populous parts of the city, where the streets were narrow and most dirty, were less affected by the distemper, than others which were more airy and kept clean. In the reign of Charles the Second, when the plague raged at London, the physicians advised all the privies and shores which were usually kept close shut, to be opened, and this foetid stench being diffused through the whole city, the plague abated. On the contrary, we read that it was stopped at Athens by sprinkling the streets with wine (*l*). Hence it seems we may justly conclude, that the causes of epidemic diseases inherent in the air are various. It has been before observed, at § 1210, when treating of the cure of the pulmonary consumption, that earth insipid when dry, if moistened diffuses a

(*k*) Mémoires de l'Académie des Sciences, Ann. 1751, p. 137. (*l*) Le Clerc. Histoire de la Médecine, p. 90.

fragrant

fragrant, and indeed strong odour: it also appears that earth cannot easily be deprived of this property of emitting an odour, seeing that Reaumur for fifteen successive days, made little cakes of wet earth, which he repeatedly dried and wetted again several times every day; yet could not perceive, after these so often repeated experiments, that the earth was less fragrant if wetted again. It is also remarkable, that this odour of the earth cannot ascend to any great height. It was likewise observed that, in various places noxious vapours issue from the earth to a small height above the surface, that kill animals, which if they were held over the same vapours in a more elevated place, would receive no injury therefrom. Lastly, it was remarked, that such exhalations do not always kill all animals, but only some particular kinds (*m*). Whence Malouin justly concludes that in various places the exhalations of the earth may be the cause of epidemic diseases.

The famous Huxham remarks (*n*) that the earth when frozen emits few or no exhalations; “ this
 “ is very evident in a thaw, when all the ground
 “ grows moist as if watered, nay even almost
 “ foams as it were away, a passage being now given
 “ to the vapours elevated by the subterranean heat,
 “ which before were bound fast by the frost to
 “ the surface of the earth.” Hence he judges this to be the reason, why when a thaw comes on, after a long frost, epidemic fevers break out, as is very often observed.

Since therefore, through the motion of the earth so great a change is made in the terraqueous globe, that mountains sometimes subside, new ones arise, and the earth suddenly opens to give an exit to the

(*m*) Memoires de l'Academie des Sciences, Ann. 1751, p. 140. (*n*) De Aere et morb. Epidem. p. 19.

vapours when abundant, it is not astonishing that writers have ascribed to these exhalations, the plague of Venice which followed the earthquake that happened on the 8th of February, 1343 (o). For they might be infectious. On the contrary, when the plague raged at Oczacow, on the very day the distemper began to abate, a violent earthquake (p) happened. Quere, did any thing exhale from the earthquake antidotal to the contagion of the plague? Or did the former noxious exhalations cease after the earthquake? Truly it does not seem impossible, that exhalations should be emitted, which might prove an antidote to the plague, and others be emitted also, that might render it still more deleterious. Sorbait observes that (q) in the suburb of Vienna, called St. Udalrick's suburb, a certain fountain near the church, which before was cried up by every body, not only for its salubrity, but also as a febrifuge, at the time of the plague exhaled an infectious stench; and in this one suburb several thousand souls perished of the plague: *Ita ut viginti quinque foveas majores, cadaveribus plenas, et tria coemiteria amplissima, ita tumulis exarata, ut in iis nemo amplius inhumari potuerit, invenerit.* " So that he saw twenty five
" large trenches filled with dead bodies, and three
" very large cemeteries so crowded with graves,
" that it was not possible to have laid another body in them." On the other hand the same author relates, that at the season of the vintage, when the liquor was fermenting, the plague which then raged about Moselle, was miraculously suppressed. In like manner at Vienna, it was observed, that both during, and after, the season of the

(o) Caius Britan. de Ephem. Britan. p. 29. (p) Schreiber de pestilentia. p. 75. (q) Consil. Medic. de Peste Vienna p. 88.

vintage, the plague manifestly decreased (*r*). For the extremely penetrating vapour, called by Helmont the woody Gas, exhales from fermenting wine, and is every where diffused through the air. This vapour, if taken in with the breath in great quantity, as when any person rashly goes into a place where the wine is in an high state of fermentation, instantly disturbs all the functions of the brain, nay and frequently causes immediate death, as is too well known: yet the part of this which remains mixed in new wine, renders it so restorative and nourishing, that it is an excellent medicine for old people, as the noble Venetian Cornaro experienced himself, who lived to be upwards of an hundred years old, and continued healthy and vigorous to his last hour.

Many other things also, by their salutary effluvia, are observed to enervate the latent causes in the air of epidemic diseases. What we read in the works of the celebrated Hoffman is extraordinary, (*s*) *Halam, ante usum carbonum fossilium, quorum jam ingens copia ad salis coctionem incenditur, multis malignis morbis, febribus petechialibus, ac dysenteria, fuisse infestam, & malo scorbutico, huic urbi familiarissimo, obiisse quam plurimos; qui omnes morbi per divinam gratiam jam fere per viginti annos, ex quo carbonum fossilium usus increbuit, ex finibus nostris excesserunt.* “ Halle, before the use of
 “ fossil coal, of which now a great quantity is
 “ burnt in the salt works, was subject to many
 “ malignant diseases, petechial fevers, and dysenteries, and many died of the scurvy; a disorder very frequent in that city; all which diseases have disappeared by the blessing of God,
 “ for these last twenty years, during which period

(*r*) Ibid. p. 46. (*s*) Medecin. rational. System. tom. 2. p. 236.

“fossil coal has come into general use for firing.” He proves the wholesomeness of fossil coal, of which many people are afraid, from this circumstance, that those houses, which air perpetually passes through replete with vapours of coal, and, “stains the walls of a smoaky blackness,” do not in the least affect the health of their inhabitants.

Places near storehouses of spices, have been observed to remain uninfected by the plague (*t*). Thus also it appears, that in the plague of London, the shipwrights who were employed in ship building, escaped the infection, being perpetually conversant in air impregnated with the odour of pitch and tar (*u*). Helmont tells us (*w*) that Hippocrates made use of wine mixed with pitch; but he had such faith in the fragrancy of pitch, that he was of opinion, that the reason the Spaniards are very rarely afflicted with the plague, is owing to their wanting casks frequently, and keeping their wines in pitched skins: though the country is hot, similar to and bordering upon Africa; “nor is filth wanting, where there are hardly any privies.” Itineraries sufficiently confirm this, which relate that the human excrements thrown into the streets are quickly dried up, and evaporated in the air, not without a stench very disagreeable to strangers, till accustomed thereto by a long residence. Indeed we have just now remarked, that a stercoraceous odour diffused through the air from open privies, has been of service in the plague. Is the plague more rare in Spain from this cause? But other foetid smells have also aggravated the distemper: dirty linnen is washed in a lye made of soap; during washing a

(*t*) Act- Erudit. Sept. 1721, p. 413. (*u*) Plague no contagious Disease, p. 36. (*w*) Tumulus Pestis, p. 190.

disagreeable smell is diffused every where about, which is wont to occasion a nausea in persons not accustomed to it, nay sometimes a reaching: this smell often adheres to the linnen after being rinsed clean and dried, particularly if black soap was used, for that kind of soap is made of alkaline salt rendered more acrid, by a mixture of quicklime, and boiled to a consistence with train oil. Diemerbroeck observed the smell of soap to be very prejudicial during the time of the plague (x.) Nay he relates, that in his own hospital, three women who had been washing linnen, were the next evening seized with the plague, and died soon after, all of whom complained, that they had caught the distemper from the foetid smell of the dirty lather. He is likewise of opinion, that the ill consequences which follow the changing of linnen in distempers, though thoroughly dry and warm when put on, are owing to this foetid smell of the soap.

The use of the herb tobacco is commended by many celebrated authors, as extremely useful when the plague rages. Diemerbroeck is profuse in its praises (y), and himself used this prophylactic alone pretty freely, before dinner, after dinner, after supper, and frequently at intermediate times also. For describing his own manner of living during the time of the plague, he says: *Si vero ab ægrotorum fælore me vel tantillum alteratum sentirem, statim, postpositis omnibus negotiis, quantumvis necessariis, qualicumque diei hora foret, duarum triumve fistularum tabaci fumum suctione trahebam; nam, ut verum fatear, tabacum pro primario præservativo in peste semper habui, neque aliud melius pro ordinario usu hætenus inventum existimo, dummodo illud sit melioris notæ, ex maturioribus foliis in*

(x) De Peste. ch. 3 p. 90. (y) Ibid. p. 134. 137.

funes coactum. “ But if I found myself ever so
“ little indisposed from the smell of the sick, in-
“ stantly, postponing all kind of business, how-
“ ever urgent, whatever time of day it might be,
“ I smoked two or three pipes of tobacco, for
“ to speak the truth, I always accounted tobac-
“ co a great preservative against the plague, nei-
“ ther do I think any thing hitherto discovered
“ better for common use, provided it be of the
“ best kind, roll tobacco made of the ripe full
“ grown leaves of the plant.” In another place
he relates (z), that from the extreme foetidness of
the stools of a patient, who was ill of the plague
attended with a diarrhæa, he presently found him-
self affected with a violent giddiness, nausea, and
oppression of the breast, so as not to have the
least doubt but he had caught the distemper:
wherefore he immediately went home, “ and
“ smoked five or six pipes of the best tobacco.”
All the symptoms instantly vanished, and he felt no-
thing more of the disorder afterwards. However he
acknowledges, the same thing happened to him
three or four different times, and when he once,
being affected in the like manner, let some time
elapse before he had recourse to his pipe, he found
himself much worse, and it was a longer time
before he got rid of his complaints. A worthy
clergyman, who administered the sacrament to
the sick, as soon as he came out of an infected
house, and entered another, always smoked a
pipe or two, and thus escaped the infection (a).
He too was careful not to swallow his spittle in
the presence of the infected: for this purpose al-
so the use of tobacco may prove serviceable, as
persons who are accustomed to smoke tobacco
generally spit a great deal, whence those who

(z) Ibid. p. 235. (a) Æsop. Epulans, p. 414

use tobacco in too great quantity, are often troubled with obstructions of the viscera. Benza (*) who describes the plague which raged in Austria, in the years 1713, 1714, 1715, also commends tobacco, snuffed up the nostrils. Future times may perhaps discover similar, or yet better antidotes.

In the mean while, this morbid epidemic adhering to the air, which is only known by its effects, is not always the same, but wholly different: as we learn from the so various diversities observed in epidemic diseases, which have always puzzled philosophers and physicians, whenever they attempted to investigate their causes.

As natural history has informed us, that an incredible quantity of small insects are suspended in the air, and by means of the air are communicated to water, the infusions of plants, &c. so, as that in one single drop of water, an immense number of such animalcules may be discovered by the help of a magnifying glass, hence some have thought, that the like very small animalcules residing in the air, may be the cause of epidemic disorders. It is well known that Kircher maintained this opinion, and after him many others, even men of high reputation. While the famous Reaumur (b) asserts, that upon examining water with the best microscopes, he could discover no animated substance; but after he had infused pepper in the same water, some pieces of herbs, &c. in a little time, the whole quantity of water appeared replete with very minute animalcules; he judged that the very small flies, that skim about in the atmosphere, were the parents of these insects. It might seem amazing that such extremely tender

* De peste Viennensi, 1712, 1713, 1714, page 82. (b) Mémoires pour servir à l'histoire des Insectes. p. 431.

insects can live and receive nutriment in the acrid infusion of pepper. But little eels, swim in sour vinegar, conspicuous even to the naked eye, which Mentzel has seen metamorphosed into true flies (c). It is a known fact, that the most acrid spurge laurels are gnawed by small worms; nor are the most tender viscera of these animalcules corroded by the acrid juice of those plants, which destroys hard warts on the human skin. Whence he thinks it highly probable, that epidemic diseases may proceed from a like cause; especially if these insects are hatched in greater quantity than usual, in some particular years; as is observed to be the case with respect to caterpillars, locusts, flies, gnats, &c. We find the same opinion in Varro (d). *Advertendum etiam, si qua erunt loca palustria, & propter easdem causas, & quod arescunt, crescunt animalia quædam minuta, quæ non possunt oculi consequi, & per aëra intus in corpus per os ac nares perveniunt, atque efficiunt difficiles morbos.* “ If there are any
 “ marshy places, and they grow dry, certain minute animalcula are hatched, so small as to
 “ escape the sight, which with the air enter the
 “ body through the mouth and nostrils, and cause
 “ obstinate distempers.” As also in Columella (e), *Nec paludem quidem ædificiis vicinam esse oportet, nec junctam militarem viam, quod illa caloribus noxium virus eructat, & infestis aculeis armata gignit animalia, quæ in nos densissimis agminibus involant, tum etiam natricum serpentumque pestes, hiberna destitutas uligine, cæno & fermentata colluvie venenatas (vere natas alii legunt) emittit, ex quibus sæpe contrahuntur caeci morbi, quorum causas ne Medici quidem perspicere queunt:* “ nor indeed ought fens to be near
 “ houses, or a public road, because in hot wea-

(c) Ibid. p. 435. (d) De re Rustica, p. 168. (e) Lib. i. ch. i. page 402.

“ther they emit noxious effluvia, and breed animalcules armed with poisonous stings, which pester us in whole clouds, and also venomous water snakes and serpents produced from the mud and fermented slime, bereft of the winter moisture, from which are contracted occult diseases, the causes of which physicians cannot fully understand.” Hildanus (*f*) has remarked, that in the plague of Lausanne, a great quantity of insects had been observed the preceding years: but at the very time the plague raged in that city, *muscarum talis copia fuit, ut post hominum memoriam vix tanta visa fuerit*; “there was such a quantity of flies, that the like was hardly ever known in the memory of man.”

Whence Reaumur imagined, that in some years, the quantity of such insects in the air might be so great, that we swallow millions of them with the air in breathing. And as sometimes such a number of insects may be caught in a drop of water, as seem almost to compose the whole bulk of the globule, he concluded that mankind, in such a case, do not draw into the lungs a sufficient quantity of air at each inspiration, and that a great number of these insects adhere to and are accumulated in brazen vessels, when they are entangled by the viscid mucus that lines the inner surface of the lungs, are killed by the heat of the lungs, or are rendered so weak that they cannot keep their wings, and fly away again with the air in expiration. These dead putrified flies will injure the human body, and therefore he thinks that epidemic diseases may be produced from this cause. He adds, that the air not only enters the lungs, but is taken into the body with our meat and drink, as also through the absorbent veins, which are

plentifully distributed over the whole internal as well as external surface of the body. He therefore concludes, that a vast number of such insects, so minute as to escape the senses, may injure the interior parts of the body, as well as the larger ones which ravage the gardens and fields. The circumstance, that in those years when obstinate diseases prevail, there is frequently an unusual quantity of insects, seems to favour this opinion.

As these insects may so suddenly be multiplied, some have hence imagined, that contagion was animated, and communicated from one person to another by such insects: but this opinion is attended with many and almost insuperable difficulties. For Hildanus remarks (g), *a peste liberas non fuisse rusticorum & pauperum tabernas, in ipsis etiam altissimis montibus sitas, etiamsi inter se separatae, nullaue vicinitas & usus inter rusticos esset. Unde concludit, causam hujus pestis Lausannensis, & vicinarum partium, non solum propter contagium, verum etiam propter corruptionem aëris, fuisse*, “that
“ the huts of the peasants and poor people were
“ not exempt from the plague, though situated
“ on the highest mountains, and at a distance
“ from each other, and the peasants kept not the
“ least intercourse with one another.” Whence he concludes, “ that the cause of this plague at
“ Lausanne, and the neighbouring districts, was
“ not only contagion, but also some vicious quality of the air.” Besides, if a vast heap of minute animalcules in the air was the cause of the plague, and other epidemic diseases, it would be impossible to comprehend how the plague, by keeping a strict guard round the infected parts, is prevented from spreading to other countries;

(g) Ibid. page 306.

which however, as we learn from history, is a certain fact, and has been frequently experienced. An army of such insects residing in the air, would escape the vigilance of all guards, however numerous or well armed. Many arguments in opposition to this doctrine may be read in authors (*b*). And indeed, though Reaumur's opinion is not attended with the same difficulties, at least not with all, yet many circumstances are observed in epidemic diseases, which cannot be explained thereby; for if those diseases arise from the air contaminated by innumerable insects, almost every one must be infected in a greater or lesser degree. Sydenham remarks (*i*) of the plague of London, "that the very same year that proved fatal to so many thousands, was otherwise very mild and healthy, and that such as escaped the plague never enjoyed better health; and likewise that those who recovered were not subject to a cachexy, and other indispositions, usually arising from the foul remains left by preceding distempers." Besides, as has been said on another occasion, it has been observed, that languid, weak, cachectic, gouty habits, are less affected by epidemic diseases, than others. Reaumur (*k*) was in doubt whether epidemic catarrhs such as raged throughout all Europe, towards the latter end of the year 1732 and beginning of 1733, were not rather produced from the air's being replete with insects, than from the frequent fogs. For as the air more especially acts on the lungs, this seemed probable. But the winter season seems unfavourable to the propagation of insects; and Reaumur (*l*), relating the observations

(*b*) *Rècueil des observations sur la maladie de Marseilles*, page 58. (*i*) *Sect. ii. chap. ii.* page 81. (*k*) *Memoires pour servir a l'histoire des Insectes*, page 435. (*l*) *Academie des Sciences*, 1733. *Mem.* 589.

made by Cassini about the height of the thermometer, remarks, that from his letters dated the latter end of *December* 1732, he had learnt, that the like distemper raged at the same time in the island of Bourbon, which is situated in Africa, nay it appeared, that those at sea, though at a prodigious distance from any land, were affected in the same manner; if the same disease had been produced by aerial insects through such an immense distance, their number must have exceeded all imagination. However, Réaumur in this place, ascribes the distemper to a particular constitution of the air only, and makes not the least mention of any aerial insects.

In the Dyfentery of Niméguen, which Degner describes, it was observed, that the French remained almost wholly exempt from the disease, of whom only two old men were seized with and died of it. The Jews also escaped the distemper, and not a single person among them was seized with a true dysentery. But if such a disease had proceeded from the abundance and corruption of aerial insects, why these who breathed the same air were not infected as well as others, seems beyond comprehension.

What we read in Heister (*m*) an author of the highest credit, and who mentions the names of living witnesses of the fact, is still far more extraordinary. In the year 1711, an acute continual fever broke out at Altdorf, which though it had not the characteristic malignancy of the plague, could not however be termed benign. The distemper solely attacked the students and no one else, though the students lived dispersed in different quarters of the town, used the same diet, and breathed the same air as the rest of the inhabitants. Whence

(*m*) Medicinische Chirurgische, &c. p. 171.

it was called the University fever. Nay, the printer belonging to the university, who lived at a distance from the college, together with his servants, or journeymen, was seized with the distemper, while another printer who lived contiguous to the college, and his whole family, escaped the disease. This affair being rumoured about, several persons who lived at Norimberg sent for their children home; who nevertheless were taken ill with this fever at their own homes, and some died thereof. And what it is still more extraordinary, the professors being seized with the distemper, their children, and families were likewise affected with the same disorder, but the sick students did not infect the families in which they boarded.

Upon weighing these matters seriously, it seems the best method to confess with Sydenham (*n*) that these diseases “proceed from a latent and
 “inexplicable alteration of the air, infecting the
 “bodies of men; and not from any peculiar
 “state of disposition of the blood and juices, any
 “further than an occult influence of the air may
 “communicate this to the body; these continue
 “only during this one secret state or constitution
 “of the air, and raging at no other time are called epidemic distempers.”

S E C T. MCCCCIX.

YET, which is astonishing, scarcely excite diseases, except by human contagion.

This unknown, and frequently inexplicable something, inherent in the air, which from mix-

(*n*) Sect. 1. chap. 1. p. 42.

ture or stimulus disorders our machine, seems to diffuse itself very widely by contagion generated in the human body from this cause. Are therefore all epidemic diseases contagious, and produced by contagion communicated from one human being to another? This can hardly be possible with respect to all epidemic distempers. When double tertians which, when the paroxysms are prolonged, imitate continual fevers, rage in the autumn season, though numbers are laid up with these fevers, I have never observed, that such patients propagated infection: for when such patients, or persons just recovered from these fevers, were moved to other places, they did not infect others. In the more kindly epidemic diseases, vernal tertians, to use the expression, nobody apprehends contagion, and no cautions are made use of. Even such epidemic fevers, accompanied with the worst symptoms, which did not give the least reason to suspect malignancy, were not contagious. When in the year 1756, from the noxious effluvia of the marshes, very bad epidemic fevers raged, which carried off great numbers of people, the eruptions, petechiæ, large gangrenous blotches on the external surface of the body, inflamed parotids, and other ill symptoms sufficiently shewed their malignant species; yet they were not contagious. For those who resided in a more healthy air, though they received into their houses persons ill with these epidemic fevers, yet were not themselves infected. If those who lived in a purer, even in a mountainous air, descended into this morbid valley, for harvest work, or other employments, they were soon taken extremely ill, but upon their return home did not spread the contagion. Yet so morbid was the constitution of the air in the valley, that even those who were not seized with

with the epidemic distemper, having lost their natural heat and complexion, resembled walking carcases (*o*).

Therefore the common cause adherent in the air may produce epidemic diseases, indeed of a malignant species, which though they attack many at the same time, yet are not communicated by infection from one to another. Some taking this into consideration, entertained an opinion, that epidemic diseases, even the plague itself never, or at most very rarely were propagated by infection, but solely depended on a certain noxious quality of the air: the truth of which doctrine, an anonymous author (*p*) has endeavoured to prove by a number of specious arguments. In particular he urges this, that the first person who is seized with any distemper called contagious, cannot possibly have received it by contagion. For contagion always supposes two persons, one from whom the contagion issues, another who receives the same, and thereby sickens of the like disease under which the first person labours. Since therefore the first person, ill of the disease, was affected by it without contagion, why might not the second also, from the same causes that produced the disease in the first person? whence he concludes, that the disease might be propagated without infection. But on another occasion at § 1582, it has been proved, that diseases may be produced in the human body by manifest causes, of which causes those diseases are the effects, and yet through these, those diseases induce such a change in the body of the patient, as to occasion him to infect other persons with the same distempers, though never exposed to those

(*o*) Tozetti de l'insalubritare dell'aria della Valdinievola, p. 111, 113. (*p*) Plague no contagious disease, p. 13, &c.

manifest causes, from which the sick person himself contracted the disease. To prove which, the instance of the Camp Dyfentery is sufficient, as was then demonstrated fully. Degner in his treatise on the Epidemic Dyfentery, after fully weighing every circumstance, concludes, *Miasma illud contagiosum semel natum, potentiam consequi se diffundendi, ac per contactum aliis se communicandi*. "That this contagious miasma once generated, possesses the power of diffusing itself, and communicating itself by contact to others (q)." Indeed when this contagion is once produced, it is not necessary, that the same constitution of the air continue, from whence the disorder proceeded; but the disease goes on to exercise its power, though another constitution of the air may prevail.

The inoculation of the small pox proves this: if in a place free from the small pox, a small thread dipped in variolous matter be applied to the healthiest person, a small puncture having been previously made in the skin, though the thread may have been kept several months since it was imbued with the variolous matter, all the effects of the variolous infection certainly follow, and the humours of the sound body are converted into a like contagion, so that in every variolous pustule produced from inoculation, there exists a sufficient quantity of contagion to infect many others. In such case, the contagion does not come from the air into the human body, but adhering to a small thread is communicated to the body. Hence it is clear that contagion may be multiplied in the human body, and pass therefrom into other bodies. Nay, as I have demonstrated when treating of the small pox, a man who

(q) De Dyfenteria Neomagensi, p. 62, 63.

has lately had the small pox, for a long time after exhales that contagion from his whole body, whereby he is capable of infecting others with the like disease: and even after death the body still exhales the contagion. Moreover, it seems apparent from observations, that the air cannot diffuse far this contagion received from the body of an infected person, if all access to and communication with the infected person and place be severely interdicted (*r*). While a young gentleman in the college was ill of the small pox, he was, even from the first attack, removed from all commerce with his fellow students, and for several weeks after his recovery from the distemper, lived in a separate apartment: from these precautions, though the small pox raged epidemically, none of the other students got the infection. It is well known, that for the sake of the publick safety, suspected goods and cloaths are, for several days together, exposed daily to the open air, that the latent infection contained in them may be dissipated in the air, and lost; and indeed with the greatest success; when on the other hand, in the east, where this precaution is not taken, or only negligently executed, the plague often breaks out.

It cannot be denied, that the constitution of the air may contribute to the greater progress of a contagious disease, or to its diminution. It has been remarked in the preceeding paragraph, that the plague at Aleppo, abated, nay almost ceased during the hottest season of the year, however the contagion was not entirely extinguished, for it afterwards broke out again. Nevertheless, the heat seems to have lessened the violence of the infection. In other plagues the cold of win-

(*r*) Mead on the Plague, p. 17.

ter has rather seemed to prove serviceable. Hippocrates says, (s) *Morbi omnes in omnibus anni tempestatibus oriuntur: nonnulli tamen in quibusdam magis tum fiunt, tum irritantur.* “All kinds of distempers arise at all seasons of the year, nevertheless some happen more frequently at particular seasons, and then rage with greater violence.”

That the infection generated in an human body may adhere to other things is certain. The inoculation of the small pox plainly proves it. It has also been remarked at § 1382, that a number of tents, with some soldiers ill of a malignant fever, being sent in the same ship down the Rhine to Ghent, in order to be repaired: twenty three workmen who were employed in that business, were instantly seized with the same distemper, and seventeen of them died.

Contagion therefore is generated in the human body, when a disease exists, even produced without contagion, and the distemper once produced may be spread very far and wide by this contagion, especially when the infection exhaling from an human body may chance to adhere a long while to other matters, the same power of propagating the like disease remaining. Helmont saw a man (t), *qui, tangendo chartas pestíferas, eo ipso sensit dolorem quasi pungentis acus, moxque pestilentem Anthracem in indice digito ostendit, & post bidduum occubuit,* “who, upon touching some papers infected by the plague, felt instantly a pain like the prick of a needle, a pestilential carbuncle made its appearance soon after on his fore-finger, and he died in two days.” In the month of July, an apothecary’s servant had lain ill of the plague, in a little shed in the garden, tiled over head indeed, but without walls, and

(s) Sect. 111. Aph. 19. (t) *Tumulus Pestis*, p. 853.
wholly

wholly open on all sides, except being hung round with curtains to prevent the patient from receiving any injury from the cold air; and after his recovery, the bed curtains and rest of the furniture were taken away, except the straw on which the sick person's bed had been laid. Eight months after, the apothecary accidentally moved the straw about with his right foot, which had lain exposed, the whole autumn and winter, to the wind, rain, snow, and frosts; he presently perceived a disagreeable stench in his nose, and in a little while after felt an acute pain in the lower part of his leg just above the foot, as if the part had been scalded with boiling water; the next day the epidermis or scarf skin was elevated into a large blister, upon breaking which a quantity of blackish liquor ran out, and underneath the bladder a latent pestilential carbuncle was discovered, which could hardly be cured in a fortnight. However, he received no farther injury with respect to his health (*u*).

The venom of the plague was therefore capable of remaining such a length of time in this straw, and yet possessed such virulence as to cause an eschar on an healthy human body in a single moment. For as this straw had been laid pretty thick under the bed, though indeed it was freely exposed to the open air, yet it could not be sufficiently pervaded by the air to evaporate and extinguish the contagion. Hence appears the reason why the celebrated Mead (*w*) condemns the custom of shutting up houses: "houses thus
" shut up are so many seminaries of infection,
" sooner or later to be spread abroad. For their
" remaining shut up a month or longer from the

(*u*) Diemerbroeck de Peste Lib. iv. Observat. 119. p. 336.
(*w*) On the Plague, p. 28.

“ decease of the last infected person, signifies no
“ more than if a bale of infected goods was kept
“ opened, (the word *un* seems to have been omit-
“ ted;) upon opening Pandora’s box the infection
“ will rush out.” The shutting up of houses,
Lobb also condemns, (x) and relates many inconve-
niencies that arise therefrom, and at the same time
remarks, that this method rather increases than
lessens the number of infected persons.

Does the infection of the plague become more
virulent by delay, when it adheres to other bo-
dies? Some observations seem to favour this
opinion. The plague latent in an heap of straw,
is only touched by a leg, cloathed with a stock-
ing, instantly a pestilential carbuncle is caused in
an healthy person, attended with a violent burning
pain, as has been observed. And physicians who
have wrote on the plague, have unanimously con-
sidered the carbuncle as a worse symptom of the
plague, than the bubo. A violent plague had
raged in Guelderland for three years, but at length
had ceased: a certain captain, slept in a village
there, who having several pestilential carbuncles,
relief coming too late, died of the plague. Die-
merbroeck (y) upon his first visiting the patient,
instantly received the infection, and a large car-
buncle, attended with most acute pain, seized his
left hand. But trusting to his usual remedy,
smoking tobacco, he felt neither a fever, nor
any other complaint whatever, nor had occasion
to use any internal remedies. A soldier, who
waited on the sick officer, was infected in the
same manner, and also had occasion for no other
than topical remedies. Thus the infection of the
plague fixed itself on one particular part of the

(x) Lobb on the Plague, p. 116, &c. (y) De Peste, lib. iv.
P. 337.

body which it destroyed by causing an eschar; but induced no other change in the habit. Hence *Helmont* seems not unaptly to have said: *anthrax bubo, aut eschara, non sunt materia primitiva pestis, sed effectus, ac productum, quod pestis sibi paravit; in quo pestis sedet, quasi in nido.* “The carbuncle, bubo, or eschar, are not the primitive matter of the plague, but effects of the plague, in which the plague resides as in a nest (z).” But this contagion of the plague is so subtile as to escape all our senses, though its effects on the body may appear manifest to the senses. Hence in another place (a) he says: *venena cætera sensibili aliquo signo produntur, sola vero pestis insensibili contagio communicatur, perinde atque humani pedis vestigium odorem suum servat.* “Other poisons appear from some sensible sign, but the plague alone is communicated by insensible contagion, in like manner as the footstep of an human creature preserves its scent.” Thus dogs are capable of finding their masters by scenting their footsteps, and in like manner, hounds follow game by their scent, and at length discover the place of their retreat. Hunters well know, that hounds hunt best when what they distinguish by their smell, continues as yet adhering to the morning dew.

Besides we see, the effluvia of some bodies, pertinaciously adhere to other bodies, and indeed a very long time. I saw myself a little casket of precious wood, in which a quantity of musk had been inclosed, retain the flavour of that perfume, though for certain, at least twenty-five years had elapsed, since the casket had contained a grain of musk; yet when it was opened, it smelt so strong of musk, that a young woman, sub-

(z) *Tumulus Pestis*, p. 854. (a) *Ibid.* p. 870.

ject to hysterics, instantly fainted away, and had afterwards very strong hysteric fits. It was washed with a strong lye, and exposed to the air for several months, yet the scent of the musk could not wholly be destroyed, though it seemed very much diminished. For the casket, having remained shut close a week or two, was no sooner opened than it scented the whole house. Boyle's experiments prove that musk diffuses its scent through a great space, and for a remarkable length of time, without any perceivable loss of its weight. Whence natural philosophers commonly use this experiment, to demonstrate the divisibility of corporeal matter, which almost exceeds imagination.

If the same should hold good in the infection of the plague, it might, inclosed in packs, be spread every where abroad, and suddenly make a great slaughter, though it affected not the senses. Indeed if it be rendered more virulent from delay, or a great quantity of pestilential effluvia, constantly emanating, be collected, the same mischief is to be apprehended. This seems the reason why those who have opened bales of goods, infected with the contagion of the plague, have instantly dropped down dead; others have been immediately seized with a vertigo, succeeded by a pestilential fever, and death, in the space of a few days. For if this latent infection had been equally malignant when the goods were packed, the men who executed that business, must have been as badly infected thereby, as those who afterwards opened the bales. Whence the celebrated Fromond (*b*) concluded, that the infection of the plague adhering to goods closely packed up in bales, is rendered more deleterious by a long

(*b*) *Risposta Apologetica*, p. 150.

voyage. Some persons greedy of lucre, unpacked a bale of silk, that had been brought from an infected place, and deposited in a certain island, and shared among them this unfortunate booty, but in a short time they all died, and infected their families, so that not even one of them survived; and thus the plague had ceased in this place, nor been farther spread, had not, unfortunately, a citizen of Toulon returned home from the same place, and propagated the disease (*c*):

Lobb (*d*) advises the utmost caution to be used in opening bales of goods imported from suspected places: if they are opened in the open air, he directs the back to be turned towards the wind; that by this means the wind may blow away into the atmosphere, whatever noxious effluvia may issue from the opened bales. But if the same is done within doors, he then advises a fire to be lighted, and the doors to be left open, and the bale to be placed between the person and the chimney. For thus the air rushing in through the door towards the fire-place, will drive up the hollow of the chimney, whatever exhales from the opened bales, which ascending from the top of the chimney will be dispersed in the atmosphere, and thus pass off without doing mischief, when diluted in the air, though before, in a collected state, highly virulent, as has been observed in the preceeding paragraphs.

But how long the contagion can remain adherent to other bodies, and retain sufficient virulence to spread the distemper, cannot so certainly be determined. It seems highly probable, that if it were closely confined in any particular place, it would retain its deleterious quality a very

(*c*) Antrechaux Relat. de la Peste, p. 65.

(*d*) Of the

plague, p. 16, 17, 48.

great while, and afterwards, when its accumulated effluvia found free vent, exercise its malignant power. Many such instances are recorded in history, which informs us, that from opening a chest, which at the time of a plague many years before, had been locked up, and had continued in that state ever since, the disease was renewed. It is a known fact, that suspected goods are purified by ventilation, in order to prevent the plague. Musk, long shut up, imparts to whatever it is contained in, an indelible scent, but in an open vessel hardly emits a tolerable perfume. Sydenham (*e*), who has so carefully and accurately observed epidemic diseases, says: “ A
 “ few persons in different places die of this dis-
 “ ease for some years after a great plague, and it
 “ usually goes off by degrees; because the pes-
 “ tilential constitution of the air continues still
 “ in part, and is not yet changed intirely to a
 “ more healthful state; this therefore should be
 “ esteemed only as the gleanings of a preceeding
 “ harvest. To which relicks of the late plague,
 “ it is owing that the fevers which prevail for
 “ a year or two after a severe plague, are ge-
 “ nerally pestilential; and though some have not
 “ the genuine signs of the plague, yet they are
 “ much of the same nature, and require the like
 “ treatment.” Therefore this disposition, favour-
 able to the revival of the plague, continues a
 long while, and the following diseases partake,
 as it were, of the genius of the plague. But
 he at the same time observes that: “ Besides the
 “ constitution of the air, as a more general cause,
 “ there must be another previous circumstance to
 “ produce the plague, *viz.* the receiving the mi-
 “ asmata or seminium from an infected person,

(*e*) Sect. ii. ch. 2. p. 75.

“ either immediately by contact, or immediately
 “ by pestilential matter conveyed from some other
 “ place.” He afterwards subjoins. (f) “ Mean
 “ while I much doubt if the disposition of the
 “ air, though it be pestilential, is of itself
 “ able to produce the plague; but the plague
 “ being always in some place or other, it is
 “ conveyed by pestilential particles, or the com-
 “ ing of an infected person from some place where
 “ it rages, into an uninfected one, and is not
 “ epidemic there unless the constitution of the
 “ air favours it.” For he acknowledges, that
 he cannot otherwise conceive how it should hap-
 pen, that when the plague rages violently in one
 town, a neighbouring one should totally escape
 it, by strictly forbidding all intercourse with the
 infected place: an instance of which we had some
 few years ago, when the plague raged with extreme
 violence in most parts of Italy, and yet the grand
 duke of Tuscany, by his vigilance and prudence,
 entirely prevented its penetrating the borders of
 his dominions.

It was observed in the plague of Vienna, 1713,
 that those houses which had been used as hos-
 pitals at the time of the plague in 1679, or in
 which many had then died of the plague, were
 the first infected, and the disease raged therein
 with greater violence than in other places (g).
 Did the contagion remain dormant in these places
 for so many years, and was it now excited and
 restored to its activity by means of the fresh
 plague? Thus a great fire takes its rise from
 a small spark, and contagion increases by spread-
 ing, since it converts into its own nature the
 humours of persons affected with this dire dis-

(f) Ibid. p. 77. (g) Wiener Pest-beschreibung, p. 235.

ease. At the time of the plague of Athens (*b*), *aves & quadrupedia, quæcumque humana carne vescuntur, cum plura jacerent insepulta cadavera, aut non accedebant, aut, si accederent, & degustassent, interibant.* “When heaps of dead bodies lay “unburied, the carnivorous animals and birds “avoided those places, and if by accident any “of them, compelled by ravenous hunger, gnaw- “ed these bodies, they died soon after.” During the plague of Vienna, 1713, the flies, that sipped the blood of an infected person, instantly expired (*i*). Indeed all the humours seem to be infected with this contagion; as in the small-pox from the least particle of variolous matter the humours of an healthy body are changed into its contagious nature!

Hence Lobb concluded (*k*), that the danger of infection depended very much on the quantity of infection with which the air was impregnated, and the proximity of the person who received the infection. Nor as has been frequently observed, does the contagion seem capable of being diffused to a distance in the atmosphere without losing its malignancy. Hence we understand, the reason why the plague is observed to make but a slow progress at first. About the end of December, 1664, a person died of the plague at London (*l*), and as at this season of the year fires are generally burnt in the rooms, it is likely, that a great deal of the pestilential virus passed up the chimney and was lost in the atmosphere, so as to be deprived of its power of doing mischief; for no vestiges of this disease, were observed for six weeks after. In the month of February a second person died of the plague;

(*b*) Schultz Histor. Medic. p. 189. (*i*) Wiener Pest-beschreibung, p. 263. (*k*) Of the plague, p. 4, 5. (*l*) Ibid. p. 43, &c.

the disease then lay dormant the space of nine weeks; it then very gradually and slowly crept on, so that only a few were infected. Hence also many, avoiding all intercourse with the infected, continued to live in their houses free from the distemper, as was observed with respect to colleges and monasteries (*m*). On the other hand, in the plague of Vienna, if one person was taken ill of the plague, the contagion infected all who lived in the same house, (*n*) *communicante altero alteri, circa nonum præsertim diem, malignæ hereditatis portionem, aliquando etiam citius; & sic integræ, eaque plurimæ, extinctæ, sunt familiæ.* “One communicating to another, especially about the ninth day, a portion of the malignant inheritance, sometimes even sooner, and thus many whole families were carried off.”

But where, many persons being infected, the contagion exhaling from their bodies is multiplied, then so great a quantity may be fixed in the air, as to maintain its activity at a greater distance from its centre. “For then the way of propagating this dreadful disease by infection or contact is rendered entirely unnecessary: for though a person be most cautiously removed from the infected, yet the air, received in by breathing, will of itself be sufficient to infect him, provided his juices be disposed to receive the infection (*o*).

Thus it appears, that there is no certainty of safety, if one or two have been ill of the plague in any place, although no trace of the disease may appear for several weeks after.

(*m*) Ibid. page 46. (*n*) Sorbait de Peste, p. 11. (*o*) Sydenham, sect. 11. cap. 2. p. 76.

The same circumstance has been observed not only in the plague, but also in other epidemic diseases. Thus Degner (*p*), on the seventeenth day of July, visited the first patient that was seized with a dysentery; towards the end of the month, and in the beginning of August, but more about the middle of the month, he observed the disease creep into the neighbouring streets; and afterward, about the middle of August, it had gradually spread itself from street to street, but particularly toward the southern part of the city; so that he could distinguish and pursue its traces with great facility. Towards the beginning of September the distemper raged violently throughout the whole city, insomuch that no quarter thereof was wholly exempt from the disease; yet hitherto it was confined within the limits of the city, nor were the adjacent villages infected. Whence the infection of the epidemic dysentery, though copiously exhaled from the bodies of so many infected persons, however infected not the hamlets contiguous to Nimeguen. But when the anniversary feasts were celebrated, they occasioned, as usual, a vast concourse of the country people, who, entering the infectious houses, carried the infection back with them to their own habitations. Degner enumerates many other instances which evidently prove, that the contagion was carried from the city to other places, by the like method.

These contagious epidemic distempers at length cease sooner or later, the contagion being either rendered inert, or the predisposing causes, no longer existing, which inclined the human body to receive the infection, Sanctorius says (*q*) *Res peste*

(*p*) De Dysenteria, p. 4, etc. (*q*) No. 126. Gorter de Per-
spirat. p. 211.

infectæ inficiunt, quo usque durant proximæ, & remotæ, causæ: unica tamen deficiente, cessat virus, ad instar motus horologii, dum rotarum unica irritante quiescit. “ Things infected with the plague “ communicate their infection as long as the “ proximate and remote causes subsist: one of “ which ceasing, the infection ceases, like as the “ motion of a clock stops if only a single tooth “ of one of the wheels is obstructed.” The exciting cause, the virus of the plague, namely, may lie long dormant, and yet be capable of being again rendered active. Hence, with justice so much care is taken to purify infected things after the extinction of the disease. In the East, where very little or no care of this sort is taken, the disease, for want thereof, frequently breaks out again; while other nations, using this caution, and prohibiting under the severest penalties all intercourse with infected places, live for ages free from the pestilence.

That contagion alone, without a predisposing cause, is not sufficient to produce a contagious disease, seems proved by a multiplicity of reasons. In the East the plague ought to rage without intermission: nevertheless it ceases and breaks out again; at the time of the plague, all are not infected who live exposed to the same contagion. Strong passions of the mind, particularly terror, augment the efficacy of the infection, as all writers on the plague unanimously allow. This point has been treated of already at § 1383, where speaking of the contagion of the small-pox, being augmented through fear, Benza (*r*) has observed, that those who contracted the plague from fear, never, or at most very rarely, survived the disease. Hence he thinks, that the

(*r*) De Peste Austriæ. page 52.

Turks, who do not dread the plague more than any other common disease, do not die in such great numbers, as they otherwise would do, although this disease is remarked at Constantinople almost every year. He himself saw a nobleman, who from a window seeing the carriage, in which the infected persons were removed, through fright was seized with the plague, and died in a few days after.

It therefore appears that epidemic diseases sometimes are not contagious, while the morbid causes produced without the human body, act on the bodies of those who are exposed to those causes. Sometimes contagion is conjoined with them, which passes from one human body to another, and thus multiplies the disease. The terrible pestilences, of which mention is made in the holy scriptures, do not seem to have acted by contagion. (t) David saw the destroying angel when he prayed to God to appease the divine wrath; he obtained mercy, and the plague instantly ceased. Hence Helmont has justly said: (u) *Duas igitur, specie diversas, pestes agnosco solum; unam nempe, quæ immediate ex manu Omnipotentis, per angelum percutientem, mittitur, ad executionem occulti judicii suæ deitatis. Hanc etenim quam pestim agnoscam, eandem tamen Domino meo integraliter committo, dicoque resignata mente, fiat voluntas tua, Domine; siquidem nec remedium opto nisi pro tuo beneplacito. Finaliter itaque, pestim naturæ tantum ubique attingam, ut philosophus. Eamque voco alteram.* “ Therefore I acknowledge only two different kinds of pestilence; “ namely, one that is sent immediately by the “ hand of the Almighty, through the destroy-

(s) Ibid. p. 37. (t) Lobb on the Plague, p. 175. (u) *Tumulus Pestis*, page 850.

“ing angel, for the purpose of executing the
 “hidden judgments of his godhead: But although
 “I allow this to be a plague, yet I wholly trust
 “the same to my God, and say with resignation,
 “thy will be done O Lord, nor do I desire a
 “remedy unless it be thy good pleasure. Fi-
 “nally therefore, I every where only treat of
 “the natural plague, as a philosopher. And this
 “it is which I call the other kind of plague.”

S E C T. MCCCCX.

TH E S E are with propriety usually called Epidemics.

In the very beginning of his commentaries on the first book of Hippocrates's epidemics, Galen accurately defines what is to be understood by epidemic diseases (*w*). For he instructs us, that Hippocrates in his book concerning air, situations, and water, hath treated of epidemical or native diseases, which known only to the inhabitants of a certain place, perpetually prevail among them. But in his books of epidemics, he treats of diseases, which do not always, like epidemics, but for some time, rage every where, through cities or whole nations. Other diseases he calls *sporadic*; that is to say, such as do not commonly attack many, but persons singly, and therefore do not depend on a general, but on a particular cause. Indeed this definition of epidemic diseases is plain and adequate, and not in the least ambiguous. Ægineta call them πανδημα νοσήματα, popular and common diseases, which

(*w*) Epidem. lib. 1. charter. tom. ix. page 2.

happen

happen to many at the same time, whose generation being universal, their cause is so likewise (x). But he does not seem to have so accurately distinguished endemial diseases from epidemics as Galen, whose definition is therefore to be preferred.

Whence also Scaliger has found fault with interpreters for translating the books of Hippocrates *περὶ τῶν ἐπιδημίων*, “of popular diseases (y).” He thinks it would have been more properly translated, “of vulgar” or rather “of wandering diseases.” He calls endemial diseases, popular; epidemics, vulgar diseases: for *τὸ ἐνδημον* is what rages in a nation, but *ἐπιδημον* what roves up and down, spreads, and rages through a nation. For *ἐνδημος* may exist even without any corruption of the air, *ἐπιδημία* cannot. If therefore diseases arise from the nature and situation of the place, their cause remains perpetual, and they always appear, and are called “endemial;” but if they only spread over the country at a certain time, they are called epidemics.

S E C T. MCCCCXI.

THE nature of these is known by the rules given, 11, 12, 13.

At the numbers above cited we have treated of the method of investigating the nature and genius of diseases, their causes, and effects on the human body, in order to discover a method of cure, and select fit remedies to correct the causes of diseases discovered by attentive observation, and remove the effects of the disease on the human body. It then appears to be no trifling matter to investigate a disease yet unknown: for every cir-

(x) Lib. ii. cap. 34. p. 20. (y) Scaligerana, Thuana, tom. ii. p. 86.

cumstance that has happened to the patient is required to be known; it is necessary that they be first weighed singly, then the whole be compared together, and digested with those things which happen in an healthy state, and afterwards by strict reasoning the proximate cause of the disease and method of cure are to be collected from these all together. These are the general rules of medical practice, which take place every where; but how and with what cautions they may be applied to epidemic diseases will be taught in the following paragraph.

S E C T. MCCCCXII.

BUT the following circumstances greatly assist the physician about to cure a like unknown recent epidemic. 1st, A determination thereof to some known species, which it most resembles. 2dly, Observation whether at that time it is more rife, about the vernal or autumnal æquinox. 3dly, Attention to the spontaneous phenomena which precede, accompany, or follow, death, a recovery, a more favourable, or a worse state of the disease. 4thly, The benefit or mischief arising from those things which are inevitably done, taken in, or evacuated. 5thly, Comparing numbers of these patients together. 6thly, Abstinence from all assistance whatever, as rendering still more obscure, the doubtful, variable, changeable hidden genius of the disease.

Sydenham confesses (z), that he was frequently doubtful how to proceed when a new disease first

(z) Sect. i. cap. 2. p. 4.

made

made its appearance; “and notwithstanding the
“utmost caution, could scarce ever preserve
“one or two of his first patients from danger,
“till he had thoroughly investigated the nature
“of the disease, and then he proceeded in a di-
“rect and safer way to the cure.” For some-
times distempers offer, which although they are
entitled epidemics, “are entirely anomalous, can-
“not be restricted to any fixed form or type,
“and are so extremely irregular, both as to the
“variety and dissimilarity of the symptoms, that
“the same disease in the very same constitution of
“the year frequently appears in a various and
“dissimilar manner, as to the time of its begin-
“ning, state and declension (a).” Whence it
were to be wished, that physicians who have an
extensive practice in great cities, would meet to-
gether and deliberate, from their joint observa-
tions, on the nature of the incipient epidemic dis-
ease, and publish the best and most certain method
of cure, as well as such as had proved unsuccess-
ful. Thus many mistakes would be avoided, and if
any error was committed it might instantly be
rectified. But here the utmost attention is re-
quired, although the physicians may be practi-
tioners of very long standing, and of the highest
reputation for their skill. In a public oration which
Ramazzini delivered in the college of Pavia, to
demonstrate that “theory had no right to a pri-
“ority in physic, before practice, but that both
“these parts of medicine ought to be strictly
“conjoined,” he relates, that in the year 1576,
signs of a pestilence, by no means to be contemned,
made their appearance at Venice; and when the
fears of the people increased from the frequent
deaths, and as usual, great differences arose among

(a) Ibid. p. 6.

the physicians, about the nature of the disorder, some affirming it to be a pestilential disease, others denying it, by a decree of the senate, Jerome Mercurialis and Jerome Capivacci, what great names in physic! were sent for. These famous men accordingly set out for Venice with a splendid retinue, nor did they meet a less flattering reception. Upon their arrival, they instituted a severe enquiry with respect to the disorder, gave the physicians on both sides an impartial hearing, and afterwards, in the College of Physicians, in presence of the Doge, solemnly delivered their opinion: “ that the epidemic disease which raged, “ was not pestilential; and openly declared that “ they would cure the disease by a method and “ regimen that they should lay down.” This declaration was received with the utmost pleasure, and the city forgot all its fears: but when they ceased carrying away the infected, to distant places, with their usual carefulness, in a few days this fatal disease declared uninfected by judges of such vast authority, began to spread among the populace with greater security, so that in the space of a year almost 100,000 persons were carried off. “ However, this pestilential distemper “ behaved very politely to its judges; for it “ spared them, so that they returned back safe “ and sound to Pavia, though they lost great part “ of their retinue (b). Their method of cure “ proving injurious, the professors were dismissed.” If such great men have fell into so pernicious an error, how cautious ought physicians to be, when they are consulted about epidemic disorders, especially if there is the least suspicion of contagion. The particulars are now to be considered, to which

(b) Ramazzini Opera, p. 58.

the prudent physician ought to attend, when investigating the latent genius of epidemics.

1st, This is the first thing to which the physician, prudently investigating epidemic diseases, ought to attend. If for instance in the autumn season or earlier, a great many people are ill with fevers in a certain place, he must carefully enquire whether those fevers belong to the class of continual fevers, or are of the intermittent kind. Perhaps it will seem strange, that there can be the least doubt about this circumstance, as at §. 727. so exact a definition of intermittent fevers has been given; which, namely, by turns wholly remit, so that a full *ἀπορροή* may happen between every two paroxysms. But at §. 748. it has been observed, that autumnal fevers often exactly imitate the nature of continual fevers, on account of their longer and doubled paroxysms; though nevertheless their genius and method of cure widely differ. However, these fevers which extremely resemble continual ones, are wont suddenly to change into intermittents, when their violence remits. As soon as the prudent physician has observed this in two or three patients, he may safely conclude, that such fevers, though they resemble continual ones, yet are a kind of intermittents, and require the same method of cure. The utility of this observation is apparent.

But although these fevers may be of the intermittent kind, yet they greatly differ from simple intermittent fevers, in the number and violence of the symptoms. Hence Sydenham (c) has taught, “ that epidemic diseases differ in kind from those
“ which have the same name, but are produced in
“ another constitution of the air.” Thus I have seen epidemical pleurisies, which would not yield

(c) Sect. 1. cap. 2. p. 9.

to the usual method of cure for pleurifies, nor would bear repeated bleedings, but by the use of emollient decoctions and oily medicines were happily cured, the morbid matter being evacuated by stool. Sydenham likewise, at a time when dysenteries particularly raged, has observed (*d*), “that
 “ the fever of the same year bore a great resemblance thereto; excepting only that, in a dysentery, the morbid matter is discharged by stool,
 “ with a few symptoms thereon depending: for they both attack in the same manner, and in both cases aphthæ, and the like symptoms, are equally apt to appear. And indeed the dysentery we speak of, is the very fever itself, with this particularity, that it is turned inwards upon the intestines, and discharges itself that way.”

Hence the predominant epidemic is always to be considered in all diseases that occur during any particular epidemic constitution. Thus, as has been said in the preceding chapter, at the time when the small pox epidemically rages, a variolous fever is observed, which has all the symptoms of the small pox, except those which depend on the eruption, inflammation, suppuration, and exsiccation of the pustules. Besides, these epidemic traces are to be met with even in different distempers. Whence Sydenham (*e*) judges, “that
 “ how much soever they may differ from one another in appearance and specific nature, yet the constitution common to them all works upon the subject matter of each, and moulds it to such a state and condition that the principal symptoms, provided they have no regard to the particular manner of evacuation, are alike in all; all of them agreeing in this circumstance, that they respectively grow mild or violent at the

(*d*) Ibid. p. 9. (*e*) Ibid. p. 9.

“ same time. It is further to be noted, that in
“ whatever years these several species prevail at
“ one and the same time, the symptoms where-
“ with they come on are alike in all.”

2dly, Although Hippocrates had every where made mention not only of vernal and autumnal, but also of summer and winter diseases, yet Sydenham, from diligent observation, learnt, that the nature of epidemic diseases is changed twice a year, namely, about the vernal and autumnal equinox; and hence he has divided epidemic diseases into vernal and autumnal (*f*). Indeed he owns, “ that diseases may possibly arise in any
“ other season of the year; yet he would have
“ them referred either to spring or autumn, according as they approach thereto respectively.
“ For sometimes the temperature of the air conspires so much with an epidemic disease, as to
“ produce it before its time; and on the other
“ hand, it sometimes opposes it so much, as to
“ make it appear later, even in persons disposed
“ to receive it. When therefore I shall mention
“ spring or autumn, I do not precisely mean the
“ vernal or autumnal equinox, but take in a
“ wider compass.” Thus he remarks, that vernal epidemics sometimes appear early, as in January, and thence gradually increasing, come to their state about the vernal equinox, after which they gradually decrease, and at length disappear about the summer solstice, except that perhaps they still infect a person or two. Thus he observed the measles frequently begin in the month of January, vernal tertians in the month of February, and in like manner disappear near the summer solstice. Whilst other diseases rising in the spring and daily increasing, come not to their state

(*f*) Ibid. p. 6.

till later, *viz.* about the autumnal equinox, after which they gradually decrease, and vanish at the approach of winter. This has been frequently observed of the small pox, when it has been the principal disease of the year.

Whence, as has been said at §. 747, vernal fevers generally begin in the month of February, autumnal, in the month of August, but so as that these diseases sometimes spring up sooner, sometimes later. It has likewise been observed, that these fevers begin earliest when they attack the greatest number of persons, and *vice versa*. Thus, when about the end of June 1661, Sydenham saw some persons already seized with a quartan fever, he concluded that numerous quartans were to be expected; and the event proved the justness of his prediction.

Hence it appears, why a smaller number of sick are found in June and July, than in other months. The vernal diseases are almost worn out, the autumnal are not yet begun, or as yet do not prevail much. The Dutch are wont to ascribe the cause hereof to the use of fresh salted herrings; but the forementioned reason seems most probable.

Sydenham justly observes (g), “it must be carefully remarked, that as many of these diseases appear in the same year, some one or other of them rules over the rest, which rage less at the same time; so that this one increasing, the others decrease, and this diminishing, the others soon re-appear.”

Hence appears the reason, why it is said in the text, regard must be paid to the disease which chiefly prevails towards the vernal or autumnal equinox, to acquire a true knowledge of the

(g) Sect. 1. chap. ii. p. 8.

epidemic constitution which then reigns. "The disease must be particularly attended to which rages most violently about the autumnal equinox, for that gives its name to the constitution of the whole year (*b*)."

Sydenham also teaches (*i*), that "as all other diseases have their periods of increase, height, and decline, so also have epidemics; whence they grow every day more violent, till they come to their height, and then abate nearly in the same degree, till they become extinct, and yield to another. But with respect to the symptoms of these diseases, they are most violent in the beginning of the constitution, after which they gradually abate, and in the close thereof are as mild as the nature of the disease whence they proceed, will give leave."

But it is to be noted, that "tho' one epidemic disease is expelled by another, as one nail by another nail, yet the yielding disease does not immediately become quite extinct, but only less frequent, till at last it entirely ceases," or from a change in the constitution of the air, acquires fresh strength, and again prevails over all other diseases; when this happens he calls such diseases not only epidemic, but also Stationary (*k*), by which name, he says, he means "fevers that arise from some peculiar constitution of a particular year not yet sufficiently known. Every one of these prevails in its order, and rages with great violence, having, as it were, the ascendant over all the rest, during that continued course of years." He acknowledges that he has not yet been able to discover, whether they succeed each other in a cer-

(*b*) Ibid. (*i*) Sect. iv. chap. 1. p. 146. (*k*) Sect. iv. chap. 1. p. 243.

tain term of years in a constant and invariable order, or whether it be otherwise. Mean while he circumſpectly adds, that “ provided the thing “ be agreed on, he will not contend about “ names; though he takes the liberty to call a “ diſeaſe by the particular name which pleaſes “ him beſt.”

But yet at the ſame time any particular epidemic diſeaſe prevails, other diſeaſes beſide the epidemic alſo occur, which do not properly depend on the reigning epidemic conſtitution; theſe diſeaſes Sydenham calls *intercurrents* (*l*), though ſometimes, but not ſo frequently, they rage epidemically; it is of great conſequence to diſtinguiſh theſe nicely from the prevailing epidemic.

They are diſtinguiſhed, by their proceeding *immediately* from ſome general manifeſt quality of the air; as for inſtance, when a ſharp froſt, which has laſted a long time, and continues late in the ſpring, is ſuddenly ſucceeded by warm weather, pleuriſies, quiniſies, and the like diſeaſes uſually ariſe, whatever be the general conſtitution of the year; nay happen indifferently every year, when the like change of weather occurs. The ſame thing happens, if any perſon heated with exerciſe, throws off his cloaths and expoſes his body to the cool air. Theſe diſeaſes then Sydenham calls *intercurrents* (*m*), moſt of which, if not all, are eſſential diſeaſes, and muſt be treated by the phyſician as ſuch, according to their nature.

But Sydenham has remarked, that certain diſorders (*n*) happen reſembling theſe *intercurrents* which are not eſſential diſeaſes, but only manifeſt ſymptoms of the reigning ſtationary fever; and therefore are not to be treated as eſſential diſeaſes,

(*l*) Ibid. p. 244. (*m*) Ibid. p. 246. (*n*) Ibid.

but only as symptoms of the stationary fever, by the method which that fever requires, slightly adapted to their particular cure, as has been observed at §. 1404. For the epidemic predominates in such disorders, as has been likewise remarked.

Sydenham, in order to distinguish rightly such *symptomatic* from *essential* diseases, carefully attended to the symptoms which accompanied the reigning *stationary* fever at its beginning (o). Thus if he found these symptoms in a beginning pleurisy, or quinsy, he judged these distempers were not essential, but only symptomatic. As a proof of this, he mentions the symptomatic pleurisy that succeeded the fever which prevailed in the year 1675. “ For all that were
“ seized with the pleurisy, were afflicted in the
“ beginning, with a pain in the back, head,
“ and limbs; which were the most certain and
“ common symptoms of all those fevers that preceded the pleurisy, and continued after that
“ disease went off. Whereas, when either of
“ these intercurrents is the essential disease, it
“ attacks in the same manner in all years indifferently, having nothing at all in common with
“ the then prevailing stationary fever. Besides,
“ all the symptoms that afterward arise are more
“ apparent, as not being concealed and perplexed by a mixture of other phenomena of
“ a different nature, and belonging to another fever.” The season of the year in which these diseases, called *intercurrents*, are observed, conduces much to the confirmation of this diagnosis. Thus for instance, if a pleurisy attacks any persons towards the latter end of spring or the beginning of the summer, it will be accounted

(o) Sect. vi. chap. 1. p. 247.

an intercurrent disease, but essential, and wholly distinct from the vernal epidemic fevers, because this season of the year is extremely favourable to inflammatory disorders. But if the same disease arises at the time of an epidemic autumnal constitution, there is just reason to suspect that such a pleurisy participates of the genius of the reigning epidemic disease; whence its cure is to be attempted, by having respect at the same time to that epidemic.

Thirdly, and this is highly necessary, and may throw a vast light upon doubtful cases. For if the physician should discover by careful observation, what symptoms of the disease, precede or accompany a change of the disease into a worse state, he will use his utmost endeavours to prevent these, if they are not already present, or to correct them if they have made their appearance. But if such symptoms appear as presage a speedy recovery, or an amendment of the disease, he will frequently wait with patience, nor by any powerful remedies disturb the salutary efforts of nature to subdue the disease. On which head a vast deal has been said in the history of fevers.

But the most attentive and accurate observation is required to make these discoveries: “for
“ every species of diseases, as well as of animals
“ and vegetables, is endued with certain peculiar
“ and univocal properties resulting from its es-
“ sence. However an enquiry into the manner
“ of curing diseases may proceed very successful-
“ ly, though we are ignorant of their causes, be-
“ cause the cure of most diseases is not effected by
“ this kind of knowledge, but by a suitable and
“ experienced method (p).” When very bad fevers, of the continual remittent kind, produced

by noxious effluvia from the marshes, raged with great violence, such was their malignity, that they immediately deprived the patient of all his strength, and produced a violent pain in the head, with delirium, and comatose somnolency; nay, and in some an apoplexy. On many, petechial spots and parotids, on some, very large gangrenous blotches, broke out. Nevertheless, so violent a disease, and which had made such havock, was wonderfully cured, and without the least assistance of art, where little purulent eruptions broke out on the skin (*q*). No wonder therefore, that physicians rejoiced to see these little pustules, and in such cases trusted the whole cure to nature.

At the beginning of a plague, the contagion being in its utmost state of virulence, is so highly subtile as to kill the person it seizes instantly, and after death the body appears covered all over with purple spots. Nevertheless, no fever, or other illness preceeds death; as is usual when the morbid cause is less subtile, and as it were aims at life with a more blunt arrow (*r*). This not only holds good with respect to the plague, but as Sydenham has also observed (*s*), “all epidemics at their first appearance, as far as can be judged from their symptoms, seem to be of a more spirituous and subtile nature, than when they become older; and that the more they decline, the more gross and humoural they daily grow.” Thus for instance in the epidemic dysentery of 1670, the first autumn this disease attacked, which was stationary and continued the following years, several had no stools at all; “but with respect to the severeness of the gripings, the

(*q*) Tozzetti della insalubrità d'aria della Valdinievole, tom. 1. p. 112. (*r*) Sydenham, sect. 11. c. 2. p. 79. (*s*) Ibid. sect. iv. c. 111. p. 156.

“ violence of the fever, sudden decay of strength,
“ and other symptoms, it much exceeded the dysen-
“ teries of the following years.” And further, in
the first dysentery when it began to be accompanied
with stools, the provocations to stool, and straining-
ings were greater and more frequent, and the
stools were almost wholly mucus and blood. But
as the disease proceeded on in its course the grip-
ings abated, the stools became more natural, and
at length the epidemic constitution declining, the
gripes were scarcely felt at all, and the stools were
rather stercoraceous than mucous.

The genius of the disease is also sometimes
changed from another acceding cause, although
the epidemic may continue as before. The very
accurate Sydenham in these matters, discerned this
also. An epidemic fever prevailed, in which the
febrile matter affected the head, and brought on
a comatose stupor, especially where the cure of
the disease was attempted by sudorifics (*t*). The
disease, though various remedies were tried, gave
way but very slowly. Whence that excellent
physician, after having first directed venesection
in the arm, applied a blister between the shoulders,
prescribed two or three clysters of milk and brown
sugar, and forbidden the patient animal food and spi-
ritous liquors, judged it best to leave the disease to
itself to go off spontaneously. Thus the disease,
safely, though slowly abating, at length vanished
entirely. But while this disorder raged epidemi-
cally alone (*u*), it happened that the warm weather,
protracted beyond its usual time to the end of
October, being suddenly succeeded by cold and
moist weather, coughs presently became very nu-
merous, and seized whole families at once, scarce
any one escaping of whatever age or constitution.

(*t*) Sect. 5. c. 2. p. 213. (*u*) Ibid. c. v. p. 229.

These coughs had this particular distinction, that they excited a fever, and translated the matter of the disease, which from the epidemic constitution affected the head, sometimes to the lungs and pleura; whence peripneumonies, and pleurifies were frequently the consequences of such coughs.

But as these disorders began with the same symptoms which accompanied the incipient comatose epidemic fever, Sydenham concluded, that these diseases were not essential, but partook of the nature of the prevailing epidemic. “The febrile matter, when it was copiously deposited in the lungs and pleura through the violence of the cough, only occasioning such symptoms as belong to those parts.” The method of cure confirmed this truth: they readily yielded to the same remedies which had proved serviceable in the cure of the comatose epidemic fever. But the usual method of curing pleurifies and peripneumonies, when essential diseases, did not succeed.

Hence therefore appears, what attention and perspicacity are required in treating epidemic diseases.

4thly, This is that doctrine of the *juvantia* & *laedentia*, i. e. what makes the patient better or worse, which is of such great use in physic; of which we have already treated at § 11, as also at § 602, No. 7. For every patient does something, takes something, or tries something, to alleviate the disorder that he feels. While various things are thus tried, some of these are observed to do good, others to do harm. (w) *Haec, similiaque, cum continuo inciderent, diligentes homines notarunt, quae plerumque melius responderent, deinde aegrotantibus ea coeperunt praecipere. Sic medicina orta, subinde*

(w) Celsus in the preface, p.

aliorum salute, aliorum interitu, pernicioſa diſcernens a ſalutaribus. “As theſe and the like circumſtances continually happened, attentive perſons remarked what generally answered beſt, and afterwards began to preſcribe them to the ſick. Thus medicine took its riſe, ever and anon diſcerning and diſtinguiſhing what was ſalutary from what had proved pernicious, by the recovery of ſome, and the death of others.”

Then we can draw inſtruction from thoſe things alone, which proved uſeful to phyſic in its infant ſtate. (x) *Quod ſi jam incidat mali genus aliquod ignotum, non ideo tamen Medico cogitandum de rebus obſcuris; protinus enim viſurum, cui morbo id proximum ſit, tentaturumque remedia ſimilia illis, quae vicino malo ſaepe ſuccurrerint, & per ejus ſimilitudinem opem reperturum.* “If any unknown kind of diſeaſe ſhould happen, the phyſician is not on that account to imagine it proceeds from occult cauſes; but upon ſeeing it, conſider what diſeaſe it moſt reſembles, and try ſuch remedies as have been frequently ſucceſſful in that diſeaſe, and from its ſimilitude thereto, he will probably relieve the patient.” But the good or bad ſucceſs of the experiment, can alone determine whether the method of cure is to be perſiſted in or not. Sydenham acknowledges, that he treated an incipient continual fever in the ſame method which in former years had proved ſucceſſful; but, upon conſidering all circumſtances attentively, he ſoon diſcovered that this new enemy muſt be attacked with other weapons. Indeed, what Columella ſays of agriculture may be applied to medicine (y). *Uſus et experientia, dominantur in artibus, neque eſt ulla diſciplina in qua non peccando diſcatur: nam ubi quid perperam admini-*

(x) Ibid. p. 1. (y) Scriptor. Rei Ruſtic. p. 394.

stratum cessit improspere, vitatur, quod sefellerat; illuminatque rectam viam docentis magisterium. “ Use
 “ and experience are the best masters in the arts,
 “ nor can any science be learnt without commit-
 “ ting faults: for where any thing improperly
 “ managed turns out wrong, it is avoided in fu-
 “ ture, because it has disappointed our expecta-
 “ tions, and points out to us the right method
 “ of attaining the summit of the art.” Galen
 says, (z) *Dum olim Asiam gravis pestilentia invasis-
 set, a qua multi moriebantur, tunc ego secundo morbi
 die, nulla facta remissione, crus scalpendo, ad binas
 libras vacuationem fieri permisi, atque hac ratione
 periculum effugi. Multi quoque alii, hoc auxilio dum
 usi fuissent, fuere servati, ac maxime, qui larga ma-
 nu sanguinem eduxerunt.* “ Formerly, when a
 “ terrible pestilence raged in Asia, of which great
 “ numbers died on the second day of the dis-
 “ ease, I suffered two pounds of blood to be
 “ taken away from my right leg at once, by mak-
 “ ing an incision therein with a sharp knife, and
 “ by this means I saved my life. Many others
 “ also who made use of the same means, were
 “ saved, but more particularly those who lost
 “ blood plentifully.” Sydenham likewise highly
 recommends plentiful bleeding in the beginning
 of the plague (a), namely, in the true plague,
 which by buboes, carbuncles, and purple, livid,
 or black blotches, deposits the morbid matter on
 the surface of the body. But if any pestilential
 tumor has already made its appearance on the
 surface of the body, he then condemns it as ab-
 solutely prejudicial. However, in his opinion,
 it must be a large quantity of blood that is taken
 away: “ if only a small quantity of blood is

(z) De Venesectione, chart. tom. viii. p. 899. (d) Sect.
 c. 11. p. 91.

“ taken away, thereby the management of the cure
“ is taken out the hands of nature who used all her
“ endeavours to raise a tumour, without substi-
“ tuting in its stead any other sufficiently effec-
“ tual method to expel the morbid matter.” He
confirms his opinion by the testimonies and au-
thority of celebrated medical writers; particular-
ly of Leonard Botalli (*b*) who recommends plen-
tiful bleeding in almost every disorder. Concern-
ing the plague he declares, that he had been con-
cerned in the cure of this dreadful disease in dif-
ferent places, and “ that he had found no speedier
“ and safer remedy, than copious and seasonable
“ bleedings, in all his patients which were ex-
“ ceeding numerous.” Moreover Sydenham (*c*)
appeals to the physicians, who continued in town
during the plague at London, “ whether any one
“ of them had observed free and repeated bleed-
“ ing before a swelling appeared, ever prove fatal
“ to any of the infected.” And he relates, that
among the other calamities of a civil war some
years before, the plague had broke out in certain
places, from whence it was by accident brought
to Dunster castle, in Somersetshire, where some
of the soldiers dying suddenly with an eruption
of spots, it likewise seized several others. A
surgeon who had travelled much in foreign parts,
being in the service there, applied to the governor
for leave to assist his fellow soldiers who were af-
flicted with this dreadful disease, in the best man-
ner he was able; which being granted, “ he took
“ away so large a quantity of blood from eve-
“ ry one at the beginning of the disease, and be-
“ fore any swelling was perceived, that they were
“ ready to faint and drop down, for he bled them
“ all standing and in the open air, and had no

(*b*) Ibid. p. 86. (*c*) Ibid. p. 85.

“ vessels

“ vessels to measure the blood, which falling on
 “ the ground, the quantity each person lost could
 “ not of course be known. The operation be-
 “ ing over, he ordered them to lie down in their
 “ tents; and, though he gave no kind of remedy
 “ after bleeding, yet, of the numbers thus treat-
 “ ed not a single person died, which is surpris-
 “ ing (*d*).” Col. Francis Wyndham, governor of
 the castle, an eye witness, assured Sydenham that
 the fact was strictly true.

Nevertheless, other authors have observed,
 bleeding prejudicial in the plague; as Diemer-
 broeck (*e*) throughout his works inculcates. Nay
 he remarked, that if by way of preservative, as is
 frequently done, blood was taken away either by
 the lancet or cupping, in robust, healthy, ple-
 thorick habits, the plague soon followed, and al-
 most always the event proved fatal. In the plague
 of Vienna, 1679, Sorbait acknowledges, that he
 had learnt from fatal experience (*f*) *plerosque, qui*
sanguinem miserunt, occubuisse; et, si forte nonnulli
evaserunt, id evenit, quod vel plethorici essent, vel
quod solum venam pedis, et in principio, priusquam
venenum radices egisset, viresque contrivisset, secue-
rint. “ That most who lost blood, died, and if
 “ by chance some escaped, it happened, because
 “ they either were plethoric, or the vein of the
 “ foot only had been opened, and in the very be-
 “ ginning, before the poison had taken root and
 “ exhausted the strength of the patient.” I could
 quote several others, but I imagine these are suf-
 ficient to prove that the same disease epidemically
 prevailing, was treated in different ways, and that
 the doctrine of the *juvantia et lædencia* alone,
 can here afford us a safe rule for practice. In

(*d*) Ibid. p. 87. (*e*) De peste, p. 234, 240, 248, and in vari-
 ous other places. (*f*) Consil. Medic. de Peste Viennæ. p. 76.

this at least all agree, that venesection has never been of service, except in the beginning of the disease, and has always done harm, where any swelling began to make its appearance.

But this also is worthy of notice, that in epidemic diseases, and in the plague itself, the state of the blood is sometimes observed to be quite different in different persons ill with the same distemper. When Benza (g) and other physicians of Vienna intrepidly examined the viscera of persons who had died of the plague, *apparerebat, sanguinis consistentiam in uno subjecto plane dissolutam, in alio in gelatinam polypiformem, in ventriculis praesertim, cordis & cerebri, coagulatum esse.* "The consistence of the blood appeared in one subject wholly dissolved, in another it was coagulated into a polypous gelly, especially in the ventricles of the heart and brain." All physicians agree, that in an inflammatory thickness of the blood, and the diseases thereon depending, plentiful bleeding is the best remedy. But are of a contrary opinion, in cases where the blood, already too much dissolved, has a strong tendency to putridity. What has been already said concerning these different states of the blood, at § 743, may be referred to. In the history of the small pox it has been remarked, that it mostly begins with an inflammatory fever; whence so often bleeding is proper in the inflammatory stage. But it has at the same time been observed, that the same disease sometimes begins with extreme anxiety, sometimes with scarce any change in the pulse, or with a weak, low, quick pulse, accompanied with a sudden loss of strength, and great danger of life: in such a state of the disease, bleeding is improper, and widely different

(g) Histor. Relat. pestis, p. 7.

remedies were to be tried, as has been mentioned.

Indeed we perceive, that in those cases where Sydenham found bleeding useful, there existed an inflammatory thickness of the blood (*b*). In the case of a young man of a sanguine complexion and robust constitution, after three plentiful bleedings, Sydenham advised a fourth, which the young man's friends opposed: the next day purple spots appeared, and the patient died within a few hours after; "the remains of the peccant matter, which ought to have been entirely carried off, as bleeding so frequently repeated left no room to expect an abscess, by its stay corrupting the whole mass of blood, and destroying the texture thereof by its extreme subtilty." Upon comparing this with what he has just before said concerning the plague; it will appear that even in this case, in which an inflammatory diathesis of the blood existed, the humours were too far dissolved, through the strength of the disease (*i*). These are his words: "As the chief malignity of this disease lies in the more spirituous parts of the blood, whence the motion of its grosser particles is generally somewhat more languid than in other inflammations, this finer part acquires a much more violent motion by this additional heat, and at length entirely breaks down all the fibres of the blood now preternaturally distended. From which dissolution of the sanguineous fibres I judge the origin of the pestilential spots or eruptions should be derived," *etc.*

However, the excellent author owns, that tired out with the obstacles he met with, by which he was frequently prevented from taking away a sufficient quantity of blood, he had

(*b*) Sect. 11. chap. 2. pag. 91. (*i*) Ibid. pag. 91.

changed his method, and had successfully attempted to cure the disease by sweating, provided no swelling had yet appeared (*k*). He now prescribed only one moderate bleeding, according to the strength and constitution of the patient, the sick person lying in bed. And soon after, the patient being covered over with cloaths, he administered warm sudorifics, with draughts of sage posset-drink, or mace ale, between whiles, and directed the sweat to be continued for twenty-four hours at least. He therefore began with bleeding, only that the patient might undergo without damage the hot regimen necessary to produce sweats: but the inconveniences which he apprehended, from a sparing use of the lancet, were removed by the continued sweating that immediately succeeded venesection.

This instance is a strong confirmation of what has been advanced with respect to the doctrine of the *juvantia* and *ledentia*, and shews its great use in discovering the latent nature of epidemic diseases. Sydenham (*l*), no friend to the vain pomp of subtle disquisitions, asks his readers pardon, wherever it shall appear he is mistaken in point of theory: “but with respect to practice he declares that he “has faithfully set down all particulars, and has “no where proposed any thing which he has not “thoroughly experienced.”

5thly, This throws a great light on the investigation of obscure diseases; for if in many ill with the same disease, some symptoms, especially in the beginning of the disease, always occur the same, from thence the genius of the distemper may be very well known, although according to the different constitution, and former way of living *etc.* of the patients, it may sometimes vary in its appearance:

(*k*) Ibid. page 96. (*l*) Ibid. page 96.

Sydenham inculcates this every where throughout his works. Thus where the small pox was epidemic; he observed many persons ill with a fever, which in the beginning was accompanied with the same symptoms as the small pox; he did not hesitate to call this fever variolous, and to prescribe the same method of cure, as he from experience had found successful in the small pox. Thus also in autumnal fevers, if the physician can discern a manifest remission, returning regularly at stated hours, and the spent disease suddenly change as it were into an intermittent, he may conclude that the method of cure used for intermittents is proper in this case; and such fevers, though they may assume the mask of continual ones, may be removed by the use of the Peruvian bark, if dangerous symptoms require its application; as the celebrated Torti has most clearly demonstrated in his observations; this circumstance has been mentioned before, in “ the History of Intermittent “ Fevers.”

Hence it were again to be wished, that physicians practising in the same place, would meet together in consultation, especially about those times of the year, when the epidemic constitutions are usually changed, that by mutually comparing their respective observations, a rational method of cure might be settled. Indeed as the old proverb says, Two of a trade can seldom agree. Let us hope, however, that all honest men have the public good sufficiently at heart, to induce them, forgetting all animosities, to co-operate heartily in this useful work.

6thly, This rule of art, is certainly of the greatest consequence, which Hippocrates has given us (m): *In morbis quos quis minime cognoscit, medi-*

(m) De locis in homine, chart. tom. vii. cap. 13. page 371.

camentum non vehemens potandum. “ In diseases which we do not understand, a powerful remedy is not to be wished for.” For what disturbances does a strong purge sometimes excite in the body both upwards and downwards! These changes made in the body by such a medicine, do not depend upon the disease alone, but on the disease acting jointly with the remedy. Besides, was the physician, while employed in investigating the nature of an unknown epidemic disease, to disturb all the functions of the body by drastic purges, he could not possibly form a judgment of the nature thereof. (n) *Omnia medicamenta sunt, quæ presentem statum dimovent: vehementiora autem omnia dimovent.* Paulo post subjungit: *nisi enim, quod morbum facit, dimoveris, augetur.* “ All things are medicines which remove the present state of the body: but violent ones disturb all the functions.” He presently after adds: “ for unless you remove the cause of the disorder, it is increased.”

Hence those seem to act rashly and improperly, who in the beginning of an epidemic disease, not yet sufficiently understood, disturb the body with powerful medicines. The prudent Sydenham says: “ Under so much darkness and ignorance therefore, my chief care, as soon as any new fever arises, is to wait a little, and proceed very slowly, especially in the use of powerful medicines; in the mean time carefully observing its nature and procedure; and by what means the patient was either relieved or injured; so as soon to embrace the one, and reject the other(o).”

He did not indeed abstain from all remedies, but only from powerful ones. He prescribes di-

(n) Ibid. cap. xvi. page 375. (o) Sect. 1. chap. 2. pag 10.
luent

luent antiputrescents, and the like, conjoined with a slender diet, consisting of such things as were sufficient to keep up the strength, without loading the constitution. In this method he persisted, carefully observing the course of the disease, and the methods by which nature attempted to expel the morbid matter. Caution is however requisite, to prevent the patient's suspecting that the physician acts the part of a spectator only; for he is apt to imagine himself neglected; but this may be easily obviated, every shop is plentifully stocked with such medicines as are particularly useful where art dictates that nothing should be done.

It might be objected, that the first patient, upon the accession of a new epidemic constitution, provided the physician does little or nothing, is by this means endangered, while a remedy adequate to the disease is either not at all, or perhaps too late administered. But this is inevitable, for in such a case the proper method of cure is as yet unknown, which would be both more difficultly and later discovered, if the natural course of the disease was disturbed, by agitating the body with powerful remedies. Sydenham candidly confesses (*p*): “ A new species of disease arising, I “ was again doubtful how to proceed, and not- “ withstanding the utmost caution, could scarce “ ever preserve one or two of my first patients “ from danger, till I had thoroughly investigated “ the nature of the distemper, and then I boldly “ proceeded in a direct and safer way to the “ cure.” While he proceeded with this caution, he readily discovered any error in the treatment of the patient. He also with his usual candor relates (*q*), that he was sent for to a young lady about one and twenty, of a sanguine constitution,

(*p*) Ibid. page 4. (*q*) Sect. 11. chap. 2. page. 89.

who besides other febrile symptoms, had frequent vomitings. He began the cure with bleeding, and next day prescribed a vomit, to guard against a looseness which usually came on in the declension of the fever, unless an emetic had been given in the beginning of the disease: visiting her next day, he found she had a looseness, hence he instantly concluded, that the disorder required a different treatment, and upon maturely weighing every circumstance, in consultation with another experienced physician, he judged that this disorder was to be treated by the inflammatory regimen, which happily succeeded.

S E C T. MCCCCXIII.

FR O M all which observed with the most accurate attention, the indication arises.

If the rules enumerated in the preceding paragraph are rightly observed, the nature and genius of all epidemic diseases whatever, will quickly and certainly be investigated, and the right method of cure found out. But best of all, as has been just observed, if a number of physicians should have, in joint-consultation, about the end of the year, determined the epidemic genius of the diseases of the year. Honour and respect are due to physicians eminent from their long and extensive practice of this salutary art; but they on their side ought not to be supercilious, nor despise the advice of younger professors. If even a gardener may sometimes speak to the purpose, how much

much more may not this be expected from physicians though young, when regularly educated, and diligent in their profession: they have an opportunity of observing the whole course of a disease and its successive changes, while the others, overwhelmed with business, view in haste some of those circumstances only which happen in the time of the disease, and are obliged to collect the rest from ignorant nurses, who do not always tell the truth. The public good will be most promoted, if the fire of the young physician be moderated by the mature discretion and experience of the old practitioner; nor let these while they instruct be ashamed to learn:

*Disce, sed ira cadat naso, rugosaque fanna,
Dum Veteres avias tibi de pulmone revello (a).*

“ Hear me with patience while thy mind I free
“ From thy false notions.”—

DRYDEN'S *Perfius*.

(a) Aul. Perfii Sat. V. vers 91. 92.



THE STONE.

SECT. MCCCCXIV.

WHEREVER a body entirely undissolvable is lodged in any part of the human body, an hard-crust soon applies itself thereto, more or less stony.

The concreted substance within the human body, hard, though in different degrees, always sufficiently so as to resist the touch, for the most part brittle in comparison with the bones and teeth, undissolvable in water, or in any other fluid that is found in the human body, and different from every other morbose coagulum of the human body, is called a stone.

There is scarce any part of the body, as will appear from the following observations, wherein stones are not sometimes found: whence the original matter from which stones are formed, seems to exist in the whole body, or only to be conveyed through every part thereof.

But as the sentiments of physicians concerning the origin of the stone, and its original cause, have been so various, it will be worth while, to consider the experiments made by the celebrated Boerhaave, to ascertain the nature and origin of the stone.

The stone is hardly ever taken notice of, nay cannot be discovered, when first beginning to be
formed

formed in the internal parts of the body. It then only shows itself, by signs of the animal functions being injured, when already formed, it by its size or shape disturbs or obstructs the functions of an healthy body in some particular part. Frequent and faithful observations have taught, that stones, and indeed sufficiently large ones, have lain concealed a long while in bodies, though during life, there never was observed the least sign of the existence of a stone. Nor indeed is the foetus in its mother's womb exempt from the stone: A stone equal in size to a large pea has been found in the pelvis of the kidney of a new born male infant. (s) It would conduce much towards the discovery of the nature of the stone, if it could be discerned by the senses in its very original formation. And as stones are more frequently met with in the urinary passages, than in other parts of the body, and remaining longer in the urinary bladder, acquire a remarkable increase of size, hence hopes were entertained, that the rudiments of the stone might be discovered in the urine: the celebrated Boerhaave therefore examined the urine in the following manner.

He made choice of the urine of an healthy man, in whose family, with which he was well acquainted, there had never been the least suspicion of an hereditary calculous disorder, neither in this person himself had there ever been observed the least sign of a latent stone.

He received into a clean cylindrical phial about the diameter of ones middle finger, the urine of this person in perfect health, made about twelve hours since his last meal, and after a good night's rest: While the urine was yet warm, which was of a yellow cast, and perfectly pellucid and homo-

(s) Locseke, Observat. Anatom. Chirurgico-Medic. page 39.
geneous,

geneous, he examined it with a microscope, but could not discover in the bottom of the glass, which was extremely white and clear, nor in any other part, the least heterogeneous substance.

This urine was left in the open air, rather warm, (for Fahrenheit's thermometer was at seventy-two degrees) the mouth of the cylindrical vessel being only covered with paper, to keep out the dust. In about seven minutes and an half, the urine was again inspected with the microscope; it now appeared full of corpuscles, which did not seem to have a smooth and equal surface, but resembled little flocks of wool: these corpuscles were shook pretty rapidly up and down, so that as some descended others ascended: from this experiment the parts seemed of equal weight, nor did any outweigh the rest, for the little flocks which descended, ascended again, and so *vice versa*.

Soon after something whitish began to appear in the urine: at the same time also were observed streaks, as it were pinguious, resembling those which appear when spirits of wine are gradually poured into water; for at that time before the spirit is thoroughly mixed with the water, such little fat substances appear. While this new phenomenon was examining by the microscope with the utmost accuracy, a cloud appeared to be formed by degrees out of these pinguious striæ, which at first hung pendulous through the whole cylinder, but gradually receded more and more from the sides, and at length was collected towards the axis. In urine this is usually called *Innatans*, *Suspensum*, *Enæroma*. “Innatant, suspended.”

Those little flocks, which before moved through the urine, began now to disappear, and were collected into a little cloud, which becoming thicker every moment, began to descend, and at length subsided,

sided, in the cylindrical vessel six inches in height, to the distance of half an inch from the bottom of the vessel; there was about an inch distance between the upper part of the cloud, and the utmost surface of the urine.

But this whole cloud viewed with the microscope, contained extremely minute shining concreted little crumbs, in its whole compass, and also in its interior substance. And likewise the like shining little particles began to adhere to the bottom and sides of the glass.

These little crumbs, at first white, in about half an hour's time grew reddish, then became of a deeper colour, and in about the space of two hours were of the same colour as the sand of urine, which is deposited at the bottom and sides of a chamber pot, wherein urine has been suffered to remain some time. However these rudiments of a forming stone continued so entangled with the cloud, that they would not fall to the bottom of the vessel, but appeared under the form of a brownish cloud.

By degrees some of these little crumbs were so increased in bulk, that they subsided to the bottom: at the same time, and in the uppermost surface of the urine which was contiguous to the air, like *moleculæ* concreted, which upon lightly shaking the vessel, soon fell to the bottom. In like manner also, these molecules increased in size, all round the sides of the vessel, so that at the expiration of twenty-four hours they were equal in size to grains of mustard seed.

They were of the figure of a Rhombus, whose opposite angles are obtuse and equal, other parallelipid molecules ran between them, redder and larger than the former.

Some square grains sometimes ran between, but very few.

It was never observed in these experiments, that molecules concreted in the urinary cloud as large as those which were formed on the sides and bottom of the cylinder that contained the urine.

It appeared also, that these Rhomboidal molecules here and there affixed themselves to each other by the sides, so as to become of a larger size, from six such corpuscles being mutually attached to each other.

This rhomboidal figure of the rudiments of a stone is confirmed from the observations of Peyrescus. For Gassendi in the description of his life has the following words. (t) *Ut de sabulo autem illo calculoso observationem adjiciam, animadvertit ille primus ipsum a natura ita conformari in figuram rhomboicam, ut, microscopio inspectum, appareat, veluti rhomborum latereorum congesta moles. Ex quo difficile non est, causam explicare illius doloris, quem sabulum ejusmodi cum urina egestum creat, nempe singulorum granorum acutiores anguli canalem ita vellicant, ut sui sensum acerrimum faciant.* “ But
 “ to add an observation about that calculous sand,
 “ he first observed, that it is by nature so formed
 “ into a rhomboical figure, that viewed in a
 “ microscope it appears like an heap of rhom-
 “ boical bricks. From which circumstance, it is
 “ by no means difficult to explain the cause of
 “ the pain which sand of this kind, voided with
 “ the urine, creates; for the acuter angles of each
 “ of these grains, so vellicate the canal, as to render
 “ its sense of feeling extremely acute.”

It has been observed, that the calculous sand thus forming, is of a red colour in the urine of healthy people: in some it is perceived to be yellow, greyish, white, and sometimes but very seldom, black. Many think they have

(t) De Peiresc. vita, pag. 150.

observed, that worser stones are produced, when the sand is of any other colour than red.

Hence the stone is produced by granulation or chrySTALLIZATION, not from different elements in the body, or from a confused mixture of concreting humours, but by the application of like elements.

These rudiments of the stone also exist in the urine of the healthiest persons; which, if they are fecerned together with the urine, before they have separated therefrom and began to coalesce, in no respect injure health. But as it has been observed, that this separation of the rudiments of the stone is sooner made in some persons, more slowly in others, it appears, that they are most likely to be afflicted with the stone, in whom this separation of the sand soonest takes place. Does not sometimes this separation happen immediately in the kidneys and in the bladder, before the urine is voided? Certainly. I have frequently seen myself, excreted nephritic sand voided with the urine, and instantly subside, while the urine was yet hot and smoaking, to the bottom of the chamber pot. It sometimes has happened, that plenty of hard nephritic sand, has been found in the linnen clouts of infants, which seems to have been voided with their urine. For as great care was taken to keep these children perfectly clean, being of illustrious birth, it hardly seems possible, that this sand could be produced in the urine evacuated, within the space of an hour or two.

This sand concreting in even the healthiest urine, may be called native stone; from which no person whatever is free; but which seems then only to be feared, when it quickly concretes in the urine. Happy those, in whom this separation is slowly made. I have frequently examined my own urine, and with pleasure observed these first
rudi-

rudiments of the stone very slowly separated, and sometimes twenty-four hours and above, before they could coalesce into gravel of a larger size. But although I am above sixty-five years of age, I have all my life been entirely free from nephritic complaints.

To what size this native stone may grow, does not seem clearly ascertained. It is very probable that this gravel, naturally, does not grow to a very large size. I left some urine for several months in the same vessel; which was encrusted with gravel every where round the bottom and sides, but each grain of sand did not exceed the size of a mustard seed. Whence, when a stone is formed without the body, lateral concretions are extended by lateral apposition in the clear fluid, the grains of sand or gravel themselves not much increasing in size. Nor have I been able to manage, so as to cause a stone to grow larger in urine, though kept a great while: for the incrustation only proceeded; but a greater stone was not cemented together in the urine itself. Whence the rudiments of the stone, seceding from the urine, seem capable of adhering to the internal surface of the bladder, and thus causing a calculous incrustation, but not of being reduced easily into a larger stone, unless from the accession of some other cause. But as the bladder, when the urine is entirely evacuated several times in a day, is so greatly contracted, as to leave scarcely the least cavity, it hence seems that all concreting sand or gravel which began to adhere to its inner surface, must be rubbed off. Mean while there is an excellent observation, that the bladder may be so encrusted. Drelincourt (*u*) in the letter which he sent to Count Valot first physician to the King of

(*u*) Opuscul medic. pag. 160.

France, speaking of an old man who died after the operation of lithotomy, describes the state of the bladder, as it appeared upon dissection. “ It was in several places knotty and callous, with hard schirrous prominent tumours, to which a calculous substance had adhered so firmly that it could by no means be separated therefrom: and also a quantity of like sand or gravel, solid but friable was found loose in the bladder, adhering to no particular part.” He at the same time remarks, that this bladder was of the same thickness as the gravid uterus, and so hard, that it resembled horn softened by means of fire, and was incapable of extension or compression. Now such a bladder could not contract itself, and thus sweep away the gravel which separated from the urine, began to adhere to its sides; this therefore firmly affixed itself to those schirrous tumours where all contraction of the bladder had ceased; while in other places, softer and still capable of motion, the gravel beginning to adhere, fell off; whence the heaps of such calculous matter in the cavity of the bladder took their origin.

Thus Morton (w) in the body of an old woman, who died of a consumption, found not only in the kidneys and gall bladder, a great many stones, but also, *Emulgentes Venæ, quæ sanguinem a renibus referebant, præ insigni calculosa sanguinis diathesi qua misera hæc vetula afficiebatur, quasi lapidei canales, intus plane calculosa crusta (dictu mirandum) obducebantur.* “ The emulgent veins, “ which carry back the blood from the kidneys, “ by reason of the extraordinary calculous diathesis of the blood, which prevailed in this miserable old woman, as though pipes of stone

(w) Opera Medic. Phthisiolog. lib. iii. c. xiv. Hist. v. towards the end.

“ (wonderful to relate) were evidently lined within
 “ with a calculous incrustation.”

I have often seen calculous sand, not only in the very substance of the uterine placenta, but also its convex surface, which comes in contact with the uterus, rough from the adhering gravel. What is read in Parey (x) where he treats of the causes of difficult and tedious labour, is still more surprising. These are his words: *Animadverti ego aliquando mulierum duarum, quas mortuo in utero factu-expediveram, secundinas plenas et distentas arena, ei simili, quæ in ripis fluminum reperitur, adeo ut sua utriusque arena libram penderet.* “ I have observed formerly in two women, whom I delivered of dead children, the membranes filled and distended with sand, like that which is found on the shores of rivers, so that the sand contained in each would have weighed a pound.” Moreover it is to be remarked, that so great a quantity of sand had been formed within the space of a few months, and yet all those grains of sand had continued separate from each other, and not been united together into a larger stone.

Hence although the rudiments of the stone exist, not only in the urine, but also in the other fluids of the body, yet it does not appear, that from these alone, without the accession of some other cause, a large stone can easily be produced: the calculous grains indeed readily adhere to an expanded surface, but remain separate, nor are reciprocally united together, so as to increase to a larger size.

We shall therefore consider, what repeated observations and experiments teach us concerning the growth of the stone.

(x) De Generat. homin, c. xxix. apud Spachium, p. 421.

If the smoothest quill is dipped in healthy urine fresh made, it acquires a crust of very soft sand, which adheres to it, and when fresh urine is again poured on it, encreases in quantity. Thus the stone may be generated out of the body; namely, when another solid body is put into the urine; to which, as to a basis, the elements of the stone are collected and adhere. Whence the material cause of the stone exists even in the most wholesome and sound fluids of the body; but an indissoluble substance, existing in some particular place in the body, affords the occasional cause, attracting to itself the elements of the stone, even in persons in whom no propensity to the stone was ever observed. For the stone is formed by external apposition, nor does it grow, like organic bodies, by the extension of vessels, but by the deposition of calculous matter to the first basis, and indeed, which is wonderful, from the sound human fluid that is found in the place where the stone is formed.

(y) The celebrated Nuck has demonstrated this by an happy experiment. Having opened the abdomen of a live dog, he drew the bladder out at the wound, and made an incision in the bottom thereof with a sharp knife; through this wound he introduced into the cavity of the bladder a little round wooden button; and as soon as the fibres of the bladder were in a state of contraction, he replaced the bladder in the body in its natural situation, and sowed up the wound of the abdomen. The animal for the first two days seemed dull and sick; but in a little time its appetite and natural alacrity returned; and the only complaint that was observed to remain, was a more frequent inclination to make water than

(y) Adenographia, page 78. etc.

usual. After the expiration of some weeks he dissected the dog in his private theatre at his own house, in the presence of his pupils, and, *particulam ligneam, ex vesica extractam, vestitu calculosa indutam representavit. Dissimili haud modo, quo saccharum candizatum album bacillis suis adhærere videmus.* “ The wooden button being extracted from “ the bladder, appeared covered over with a “ calculous shell, in a manner not unlike that in “ which we see sugar-candy adhere to its sticks.” From which he concludes, that in like manner, a stone first formed in the kidneys, and then carried into the bladder, constituted the nucleus, to which afterwards the calculous substance grows, and thus, in length of time, the stone frequently acquires a monstrous size.

He at the same time observes, that any other heterogeneous substance, slipping into the cavity of the bladder may constitute the nucleus of a future stone. Thus he relates from Tulpius, (z) that a wild bull gored a man, and the horn pierced the cavity of the bladder: By the negligence of the surgeon, a large tent, that was introduced into the wound, slipped into the bladder, and was left there, the wound gradually healing up. Some time afterwards, the usual symptoms came on, which generally accompany the stone in the urinary bladder; and the operation being performed, the Lithotomist extracted a stone the size of a man's fist, which inclosed the tent that had formerly slipped into the bladder; however, the patient recovered. The famous Lucas Schacht, formerly professor of medicine in Holland (whose grandson now supports, with the greatest reputation, the dignity of the office and name, in the university of Utrecht) was surprised to see ex-

(z) Ibid. pag. 80.

tracted from an human bladder by Smaltz the famous Lithotomist of that time, (a) *duas fistulae tabacinae partes, calculosa crusta notabiliter obductus.*

“Two pieces of a tobacco pipe, remarkably encrusted over with a calculous shell.” The poor wretch had undergone the operation some years before, and had attempted to allay the itching of the wound not quite healed, by scratching it with a piece of a tobacco pipe which by accident was at hand, a piece of this slipping into the bladder, and being thus encrusted with calculous matter, was the occasion of his being obliged to submit to this second operation, in order to extract the extraneous body.

Many observations are related in medical history, which clearly shew that various foreign bodies may afford the basis of a future stone. (b) It is recorded in the *Acta Eruditorum*, that an ivory hair pin four inches long was extracted from the bladder of a young woman: this pin had perforated the bladder in such a manner that part of it was contained within the cavity thereof, and part projected out of the bladder: after having remained in the body nine weeks, it was extracted through an incision made above the *os pubis*. In this case it is particularly to be remarked, that the more obtuse end of the pin which stuck in the cavity of the bladder was all over encrusted with a calculous substance, the smaller end which was without the bladder, remained smooth and bare. The patient pretended, that this pin had by accident slipt down her throat, as she was endeavouring to promote an inclination to vomit, by irritating the fauces. But if the whole history is attentively considered, we shall readily perceive what degree of credit ought to be

(a) Ibid. pag. 82.

(b) Anni 1700. pag. 231.

paid to this story: for the very next day she complained of an acute pain below her navel towards the right side, which pain in the evening approached the right groin. And a surgeon being sent for on the fourth day, *acum, non quidem circa anum, sed immisso in uteri vaginam digito observabat, et quoniam misera de urinæ difficultate conquerebatur, applicato cathetere, acum in vesica tangere sibi videbatur etc.* Quatuordecim dies post immissus catheter manifesto acus in vesica præsentiam prodebat. “Who
 “not indeed in the anus, but upon introducing
 “his finger into the vagina felt a sharp body,
 “and as the patient complained of a difficulty
 “in making water, a catheter being introduced,
 “seemed to him to touch a pin in the bladder
 “etc. Fourteen days after the catheter being
 “again introduced plainly disclosed the presence
 “of the pin in the bladder.” Many like histories are to be met with, where physicians have racked their brains, to explain how things swallowed, could arrive whole in the bladder. Had they been less credulous, they would have found out an easier way. Molinetti publicly showed, *calculus ad ovi magnitudinem, circa acum osseam in vesica collectum, quem puellæ Venetæ extraxerat. Acus per annum in vesica latuerat, quæ lascivienti, dum se ea fricaret, e manibus præter opinionem in vesicæ cavitationem elapsa erat.* (c) “A stone the size of an
 “egg, formed in the bladder round an ivory
 “bodkin, which he had extracted from a venetian
 “girl. The bodkin which, contrary to her imagination, had slipped out of the girl’s hand into
 “the cavity of the bladder, while she was playing with it in a lascivious manner, had lain in
 “the bladder an whole year.” After three months had elapsed since the accident, Benevoli extract-

(c) Thom. Bartholin. Epist. Medic. Cent. 11. pag. 688.

ed from the bladder of a girl a wooden needle case, which was already almost wholly encrusted with calculous matter; and at the same time extracted several stones, some as large as small nuts, others less; and by means of injections thrown into the bladder, cleared away a quantity of gravel; and thus the patient was happily cured, so as never after to experience the least return of her complaints. (*d*)

Benevoli, wondering how a body of such a great size could have passed through the sphincter of the bladder, asked the patient several questions; but as his questions seemed to give the poor girl the greatest uneasiness, he on that account declined a further enquiry.

A similar instance is recorded, (*e*) where a long iron pin, slipping into the bladder, afforded the basis of a stone, that enclosed it all round, in the space of twenty months: this poor girl had concealed her disorder, till almost dead with pain, she was forced to confess the matter. But although the stone was extracted, through an incision made above the *os pubis*, and no bad symptoms happened in consequence of the operation, yet she died the third day after, her strength being entirely exhausted. A girl two years of age, without any known cause, began to suffer violent cholicky pains, and had also a dysury, which were palliated by proper medicines: in the third year of her age, she felt acute pains about the *os pubis*, had frequent vomitings, and sometimes a suppression of urine. She found remarkable relief from the warm bath. All her complaints encreased till the fourth year of her age, when the private parts began to be very

(*d*) Dissertaz. ed observez. Ant. Benevoli Offerv. xxii. pag. 205.

(*e*) Académie des Sciences, 1750. pag. 5.

painful, swelled, and inflamed : a fluctuation was afterwards perceived in the right *labium pudendi*, and some purulent matter was formed in the external orifice of the vagina. Emollient cataplasms were applied to the part, and in two days her mother perceived an hard white substance in the extremity of the *vagina*, and the same evening while she was fomenting the part, out dropt a stone that weighed above half an ounce encrusted over a needle, but so as that both ends of the needle appeared to project beyond the calculous substance, free from all incrustation, (*) In this case the suppuration had prepared the way for the passage of the stone. But how this needle had made its way into the bladder of this child, could not be discovered.

John Caspar Bauhine used to shew his acquaintance a stone, which a very able and experienced Lithotomist had attempted in vain to extract from a robust man about forty years of age : a leaden bullet had been the basis of this stone, which remained immoveably fixed within the calculous substance. In the groin of the dead body appeared a small cicatrix, and the man himself had been a soldier in his youth, and frequently used to tell his acquaintance, that when in the service, he had been wounded by a musket ball which had never been extracted. But there appeared no mark of a wound or scar, in the membranous part of the bladder. (f) If the bladder was distended with urine at the time the wound was received, upon the urine's being evacuated, it might be so contracted and corrugated, that the cicatrix might disappear in twenty years, especially as there only appeared a

(*) Medical Essays, Vol. iv. pag. 297.
 tholin. Epist. Medicin. Cent. 111. pag. 128,

(f) Thom. Bar

small scar in the groin. This however is certain, the bullet became the nucleus of a stone in the bladder. Several worthy people have assured me, that they have divers times seen similar cases.

A skilful Lithotomist cut a calculous patient, and extracted from his bladder a stone that resembled a bunch of berries, it had for its nucleus an ear of wheat, encrusted with stony matter. The patient being interrogated, said he remembered, that formerly when he lived in the country, being afflicted with great pains, he had attempted to search the urethra with an ear of wheat, which when introduced he not being able to withdraw, had disappeared. (*) Many similar cases are read of in medical history; and not long ago Sir — Brady, first physician to his serene highness Prince Charles Duke of Lorrain, etc. sent me part of such an ear of corn incruusted with stone, which the very skilful and dexterous surgeon Himmelbauer extracted from the urethra of a soldier sick in the hospital. Indeed the patient obstinately denied his having thrust this ear of corn into his bladder. But there is no other passage by which such an ear could have come into the bladder; and a case altogether similar teaches, that patients are not always to be believed: (g) By the operation, an ear of barley was extracted from the bladder of a man, wholly incruusted with stone, and indeed so greatly, that, *fragmenti calculi delapsi pependerit uncias quatuor et semis*. “The fragments of the broken stone weighed above four ounces and an half.” The Lithotomist in vain endeavoured to learn from the patient how the ear of barley came in the bladder, for he always pleaded ignorance of the matter: whence

(*) Academie des Sciences 1753, pag. 128. (g) In disertat. Christ. Tilling Lipsiæ habit xiii. Decemb. 1737.

the surgeon suspected, that a wound in the anus had communicated with the bladder, and that the ear of barley being swallowed, by this means came into the bladder. The celebrated Platner being asked his opinion of this case, made answer, that it seemed to him beyond doubt, that the patient, either to allay some uneasy sensation, or out of wantonness, had introduced the ear of barley into the urinary canal, and afterwards, when it could not be drawn out without great pain from the resistance of the hard husks, he had forced the whole ear into the bladder. And that this was really the case, the man at last ingenuously confessed, upon a strict examination.

The celebrated Morand has collected several similar cases (*b*).

From what has been said it appears, that the elements of the stone, which lie concealed in the urine even of the healthiest persons, quickly unite themselves to any indissoluble body that they meet with in the urinary passages, whether animal, vegetable, or fossil. For the cases just enumerated have afforded instances of each; nor indeed are earthy bodies excepted, when burnt in a violent and long continued fire; such as tobacco pipes, *etc.* All these things therefore are capable of affording a basis and nucleus to a forming stone.

But there does not seem to be any body to which the elements of the stone are more easily united, than stone itself. Whence if a small stone formed in the kidney, should descend through the ureter into the bladder, unless it be soon voided, it will in a short time encrease in bulk by the daily apposition of fresh calculous particles. Thus very frequently such a smaller stone is found in the very heart of a larger stone. I have broke to pieces a great many stones taken out of the hu-

(*b*) Academie Royale de Chirurgie, tom 111, page 605, *etc.*

man bladder, and have seen many broken ones in the cabinets of famous lithotomists, which had such a kernel; so that we may justly conclude, that a renal stone is most frequently the basis and ground-work of a stone in the bladder. Denys, celebrated for his success in cutting for the stone (*i*) according to Rau's method, declares that all whom he freed from the stone by the operation, had previously felt symptoms of the stone in the kidneys; and confirms this fact by several instances.

From which it appears, that there is no great danger to be apprehended from the gravel, called nephritic, which concretes in healthy urine, so that it does not affix itself to any indissoluble basis: it may incrustate the inner surface of the bladder, if it should happen not to be sufficiently contractile, and at any cause whatever the urine retained long in the bladder; but will scarcely ever concrete into a stone of any size. A man had frequently been afflicted with nephritic complaints for several years, seldom made water without difficulty, and very often voided red gravel with his urine; at length he was seized with most acute pains in his loins, and a violent fever, attended with convulsions, which carried him off. Among other things observed upon opening the body, an hard tumour was found in the right ureter, near its opening into the bladder, which upon being cut into, exhibited to view a stone of an irregular shape. The cavity of the bladder contained very little urine, and the sides of the bladder were in different places incrustated with small gravel (*k*). A calculous diathesis prevailed

(*i*) Heelkundige aanmerkingen over den steen der nieren, blaase, *etc.* pag. 99. (*k*) Hasenohrl Hist. feb. petechial, pag. 64.

in this person; the stone was situated in the right ureter, but so wrapped up in a membranous substance, that the urine contained in the bladder could not flow over the stone; the urine deposited gravel even in the bladder itself, which was frequently voided with the urine: however no stone was from thence formed in the bladder; but its sides were encrusted with a shell of stone.

This circumstance throws a light upon the following aphorism of Hippocrates: *Quibus in urina subsident arenosa, illis vesica calculo laborat.* “Persons in whose urine gravelly substances subside, labour under the stone in the bladder.” It is to be remarked, that a dispute arose between the learned physician Beverwyck (*l*) and Claudius Salmasius (*m*), concerning the meaning of the above aphorism. Beverwyck, an able practitioner in medicine, had often observed persons void gravel, who were perfectly free from the stone in the bladder; whence he thought Hippocrates must be wrong, if he had laid down as a sign of the stone in the bladder the settlement of gravel in the urine. Besides in another place he says the very reverse (*o*): For there, among the signs of a stone in the kidneys he enumerates; *ubi cum urina arena egreditur, et ubi per urethram arena exit vehementem in urethra dolorem exhibens.* “Where gravel is voided with the urine, and where in its passage through the urethra, it occasions a violent pain in the urethra;” he presently after adds the following words: *At multi medici morbum ignorantes, quum arenam vident, vesicam calculo laborare existimant. Hæc autem minime, sed ren calculo laborat.* “But many physicians, ignorant of the disorder,

(*l*) Sect. iv. 79. chart. tom. ix. page 89. (*m*) Beverwyck Steenslück. (*n*) Interpret. Aphor. Hippocrates de calculo, pag. 181. (*o*) De internis affect. ch. xx. chart. tom. viii. page 649.

“ when they see gravel, imagine there is a stone
 “ in the bladder. On the contrary, it is the kidney which is afflicted with the stone.” Beverwyck therefore will have it, that the word *ὑρίσαστα* does not signify the settling of gravelly particles in the urine, but the retention of these particles, which before were voided with the urine. He moreover proves, from many instances, that the word *ὑμρον* is used not only to signify urine already voided, but also urine still contained in the bladder: hence his opinion was, that a stone in the bladder was to be apprehended, if the urine, which before carried off the gravelly parts along with it, should be voided afterwards without this gravel; not because the gravel was not equally generated in both cases, but because it was retained in the bladder, and might concrete into a stone. Salmasius opposed this opinion of Beverwyck with his vast fund of learning, and endeavoured to prove the reverse. But as this great man was not a physician, it is no wonder that he has not always hit upon the true meaning of the antient medical writers; as is frequently the case in his works, when, to use a common expression, he just takes a peep at medical matters. Whence Beverwyck, though by far his inferior in learning, has maintained his opinion with success.

Later observations and experiments concerning the nature of the stone, seem to favour Beverwyck's opinion. For the elements of the stone exist naturally in the urine, and if they so easily and quickly separate from the urine, that gravel may even be collected in the bladder, such persons are justly thought to have a calculous diathesis: yet if that gravel is voided with the urine, they will remain free from the stone. But if either a little stone from the kidneys, or any other indissoluble body, should remain in the bladder,

bladder, the principles of the stone will be attracted from the urine to this basis, will adhere thereto, and will form a stone in the bladder, nor will gravel any longer be observed in the urine. The sense therefore of this aphorism might be, that if urine containing gravel before emitted, should when voided shew no signs of gravel, in such case there is reason to apprehend a stone may be formed in the bladder.

Stones therefore grow from elementary principles, which, under the appearance of a fluid, previously existed in the humours of the body, when they were mutually separated from each other; but afterwards united together form little granulations, and constitute what is called nephritic sand or gravel; which when it meets with an indissoluble basis, affixes itself thereto, encreases its bulk, and forms a stone, which as it is constantly bathed by humours containing the same principles of the stone, continually grows larger from the application of fresh calculous concretions: nor does there seem to be placed any limits to its growth, as long as the receptacle, in which the stone is contained, is capable of further distension. A young man, twenty-five years of age, afflicted with a stone in his bladder, submitted to the operation; but the lithotomist could never extract the stone, though he laid hold of it with his forceps, and brought away some pieces of it.

Upon opening the body, a stone was found that filled the whole cavity of the bladder, so as to leave room for only a few drops of urine. The bladder, which was half an inch thick, contained in its substance a quantity of purulent matter (*p*). In the copper-plate annexed, however, some distance is delineated between the stone, and the sides

of the bladder. But Cornelius a Someren, a famous physician of the last age at Dort, extracted a stone from the body of a young gentlewoman, which not only filled the whole cavity of the bladder, but with its extremity, shaped like a crooked beak, stopped up the neck of the bladder (*q*). I have myself seen a similar large stone, in vain attempted to be extracted by the operation from a young person, who yet lived some months longer: this stone entirely filled the whole bladder, and with as it were a long stalk entered the neck of the bladder.

Undoubtedly many cases are related in medical history, of stones in the bladder which have grown to an immense size. An eminent physician extracted from the bladder of an old man, a stone of an oval shape, smooth, and dense, weighing about thirty-nine ounces. As human calculi are almost always light in proportion to their bulk, it is easily conceived, that such a stone must have been prodigiously large; it is yet preserved at Florence (*r*). In the last illness only, which proved fatal to this patient, there was a slight suspicion of a stone; in other respects he had happily passed through old age, and could ride a hunting without inconvenience. In another person who, having shewn signs of a latent stone twenty years before, died in consequence of a most violent inflammation and mortification of the neck of the bladder and the adjacent parts, a stone was found in the bladder, of an oval shape, thick and hard, weighing twenty-eight ounces: besides this there was another stone that weighed six ounces, not so thick as the former, but, like that, of an oval, oblong figure, which, not being able to pass into

(*q*) Beverwyck Steenstuck, page 324. (*r*) Tozetti Osservaz. Medich. pag. 121.

the bladder, already filled up with the former stone, remained incarcerated, and was extended partly into the extremity of the right ureter, and partly between the membranous coats of the bladder, where the ureter usually opens into the bladder. The membrane of the bladder was found to be half an inch in thickness, callous, and beset with steatomatous tumours (*s*). A stone weighing four pounds four ounces was found in an horse (*t*), which for eight or ten days before its death, had laboured under a total suppression of urine, and had also during this whole time obstinately refused to drink, and by every possible means indicated the extreme torture it underwent.

Indeed 'tis true, the person who after the beast's death took the stone out of the carcase, asserted, that it was found between the bladder and the gut *rectum*; but this man seems to have been entirely ignorant of the parts of the body, and their situation, and perhaps tore the bladder, worn quite thin by so large a stone, unless it was already in part destroyed by the stone.

We learn from another observation (*u*) that large stones may be formed in the bladder of an horse: the celebrated Lemery showed the academy a stone extracted from the bladder of a mare, resembling in size a middling melon, which weighed twenty three ounces and seven drachms.

Indeed, as the stone, in whatever part of the body formed, is perpetually bathed by humours, which contain the rudiments of the stone, it is evident, that it may perpetually increase in bulk, when once a calculous nucleus exists, to which fresh elements of the stone may be applied. Hence also we learn, why often several stones are

(*s*) Ibid. page 122. (*t*) Act. erudit. 1682. pag. 344.
 (*u*) Accademie des Sciences 1700. page 52.

found in the same place in the body: namely, because several such nuclei happen to be there. I saw a man, who every month voided by the urinary passage above twenty renal stones, which he plainly felt descend from the kidneys, and could foretel when he should void such stones. They used to pass with surprizing ease, though I have seen several of them that were equal in size to small beans. Certainly such stones, if they were retained in the bladder, might afford nuclei for the formation of larger stones. Many instances are related in medical history of numerous stones lurking in the human body, which I shall not take up the reader's time to relate. But Lithotomists constantly remark, that stones cut in two, discover a nucleus in the centre, to which the rest of the calculous substance has grown in lamina.

The generation of the stone is therefore successive, not instantaneous; as Helmont imagined, who was of opinion, that a stone, and indeed a large one might be formed in a moment, by a certain petrifying spirit that pervaded all things, and produced the same effect, as poets have fabled of Medusa's head.

Helmont had observed (*w*), that the alkaline volatile spirit of urine, if mixed with pure alcohol, instantly formed a coagulum therewith; usually called *Offa Helmontii*, "Helmont's paste," though he was not the author of this experiment, but Raymond Lully many years before (*x*). Nor is such a coagulum, *album, opacum, consistens, et quidem adeo, ut de inversae lagenae osculo ne guttula quidem defluat, acsi in lapidem concrevisset*, (*y*). "White, "opake, solid, and indeed so much so, that not "even a drop will fall from the neck of an in-

(*w*) De Lithiasi, c. iv. p. 677. (*x*) Boerhaave, Chem. t. II. p. 372. (*y*) Ibid. p. 370.

“ verted flaggon, as if it were concreted into
 “ stone,” formed only by spirit of urine but also
 by a mixture of pure spirit of sal armoniac mix-
 ed with alcohol. But in healthy urine neither al-
 kaline volatile salt, nor alcohol are ever present.
 However Helmont says, these only potentially exist:
Spiritus quippe, apprehendens terram volatilem, procre-
atam semine, ac fermento fracido, et putrescente, sus-
citat occultum adhuc in potentia vini spiritum, urinae
incolam, quibus, tanquam duobus sexibus, concurren-
tibus, terreus quidam praefatus spiritus imbibit prac-
dictum unicum coagulatore; cujus reciprocationis ergo,
critur in agendo amborum connexio penitissima: quia
congregiuntur spiritu tenuis, per illorum minima. Adeo-
que coagulator coagulat unico instanti spiritum vini,
potentialiter excitum, in putrescente fermento, cui cum
fracida massa suam praebeat materiam; simul conden-
santur in verum Duelech, monstrum sane novum hoc
aliquid, coagulatum in media aqua, nec iterum, ideo
in aqua resolubile; Ens nempe petrosum, animale, nulli
alteri simile (z). “ For the spirit laying hold of
 “ the volatile earth, procreated from the feed and
 “ ripe putrescent ferment, rouses up the oc-
 “ cult spirit of wine as yet potentially existing
 “ in the urine, which meeting together like two
 “ opposite sexes, the aforesaid earthy spirit im-
 “ bibes the said only coagulator; by means of
 “ which reciprocal meeting, in the action arises
 “ a most complete union of both: because in
 “ their junction both spirits mutually penetrate
 “ through their respective particles. And there-
 “ fore the coagulator coagulates in an instant the
 “ spirit of wine potentially excited in the putres-
 “ cent ferment, to which, when the ripe mass
 “ yields it matter, they are together condensed
 “ into the true Duelech, this new something, a
 “ real monster, coagulated in the midst of water,

(z) In the passage above quoted.

“ yet

“ yet not diffolvable again in water; namely, a
 “ stony animal being, resembling no other.” But
 this concreted substance from volatile alkaline salt
 and alcohol, is not stone, but soap, which melts
 by heat, is diluted in water, and being volatile,
 of its own accord, wholly evaporates (*a*). Indeed,
 in all experiments, particularly in chemical ones,
 the greatest caution is necessary, lest a too hasty
 conclusion be drawn, especially where it seems to
 favour a preconceived hypothesis. Helmont re-
 lates a case (*b*), which in his opinion, strongly
 countenances the instantaneous generation of the
 stone by means of a sudden coagulation: *Predica-*
tor haereticus prope Barclayam in Anglia, anno 1629,
sanus atque sospes, contendens a prandio librum e su-
blimi ad se trahere, in imo ventre magno percussus pondere
atque dolore, certis inde a quatrIduo signis scivit, se
calculo gravatum. Inde post octiduum Londini, sub
novacula Lithotomi extinctus. Pendebat autem li-
bram Anglicanam, et binas insuper drachmas. Nec
memini, me parem unquam vidisse calculum. “ A
 “ clergyman near Berkeley, in England, in the
 “ year 1629, in perfect health, straining himself
 “ after dinner to reach down a book from an
 “ high shelf, was seized with an acute pain and
 “ a sense of great weight in the lower part of his
 “ belly, and in about four days time was con-
 “ vinced, from certain symptoms, that he had a
 “ stone in his bladder. At the expiration of eight
 “ days from that time, he died under the knife of
 “ a lithotomist. The stone weighed an English
 “ pound, and above two drachms; nor do I re-
 “ collect ever to have seen such another.” He
 did not think, this case could be explained any
 other way, except that the stone was formed by a

(*a*) Boerhaave Chem. t. 11. p. 372. (*b*) De Lithiasi,
 c. 111. p. 670.

sudden coagulation; for as in chemistry, a white opake mass is produced from two very limpid liquors, at the very moment of mixture, he concluded rashly that the stone was generated the same way.

But it appears from what has been just said, that a stone by far larger, namely, one that weighed thirty nine ounces, could lurk in the bladder without hardly any inconvenience to the patient. For the person was old and perfectly healthy who had such a stone in the bladder; could hunt without inconvenience, a sport in which he took great delight, and in his last illness only some symptoms appeared which gave reason to suspect a stone: whence beyond doubt this stone pre-existed in the Englishman, though unknown to him, who by attempting to reach down a book from an high shelf, changed its situation, and thereby incurred most racking torture.

Helmont also attempts to prove the justness of his hypothesis from hence (c), that sometimes one kidney is affected with the stone, while the other continues in a sound state, and performs its functions properly. For hence he deduces, *quod urina, non sui vitio, aut mucagine, ergo in sua basi petrescat; (quod jam ante sat esto conculcatum) quod denique non ex diaeta, cibum, potuumque imaginato tartaro, sed quod renes, proprio defectu, viciosum suscitent fermentum, ac tandem insolens hoc monstrum pariant.* “ That the urine therefore cannot petrify in its basis from any vicious quality or mud-
 “ diness of its own (an opinion which has been
 “ already sufficiently exploded) nor lastly from
 “ diet, from the fancied tartar of the meats and
 “ drinks, but because the kidneys from some
 “ particular defect of their own, excite a vicious

“ ferment, and at length generate this unusual
 “ monster.” But we shall demonstrate by and
 by, that the stone is not generated in the kidneys
 by a certain vicious fermentation, but from the
 nucleus or kernel being found there, which af-
 fords a basis for the growing stone.

Indeed he asserts, that this coagulating spirit,
 which produced the stone, was peculiar to human
 urine alone. *Urinam tamen equinam, nomine ar-*
mentorū, examinavit curiosus, an forte alter similis
coagulator spiritus esset, qui propter connata impedi-
menta non ubique sortiretur coagulandi imperium. At
ut ut laboravit non reperit coagulatoreū illum spiri-
tum in urina equina (d). “ Out of curiosity he
 “ examined the urine of horses, with a view to
 “ discover whether the urine of beasts contained
 “ a like coagulating spirit, which from some in-
 “ nate obstructions might not however in all cases
 “ be capable of exerting its coagulating power.
 “ But in spite of his utmost endeavours, he could
 “ not by any means find that coagulating spirit
 “ in the urine of an horse.” However it ap-
 pears from the observations already recited, that
 stones of a prodigious size have been found in
 the urinary bladders of horses; whence it is evi-
 dent what judgment ought to be formed of this
 coagulating spirit.

(e) Helmont indeed perceived, and has de-
 scribed well enough how gravel might be gene-
 rated in healthy, deep yellow, pellucid urine,
 from the elementary principles of the stone, be-
 fore dispersed throughout the whole urine, gradu-
 ally uniting together, and being collected from
 every part of the urine (f). He acknowledges
 that, *par utrabique ratio, essentia, causa, et proprie-*

(d) Ibid. p. 676. (e) In capitulo Paradoxum numero-cri-
 ticum, p. 557. (f) Ibid et de Lithiasi, p. 666.

tas, calculi in nobis orti, cum eo, qui, ejusdem identitatis, et subjecti materialis, in urina foris circum matulam coagulatur. “The stone formed in our
 “bodies, and the substance which encrusts the bot-
 “tom and sides of chamber pots, are in every re-
 “spect indentically the same, and have both the
 “same essence, cause, and properties.” He therefore
 saw the elementary principles of the stone gradu-
 ally united together into gravel, but not coagulat-
 ed in an instant by virtue of a coagulating spirit.
 He elegantly observes (g), *quemvis hominem poten-*
tialem in urina calculum habere etc; at solum eum esse
miserum, cujus nempe in urina latens petrificandi po-
testas in actum, intra pellem suam, explicatur.
 “That every person potentially has the stone in the
 “bladder, but that person only is wretched, in
 “whom the petrescent power latent in the urine,
 “is put in action within his body.” Hitherto he
 has spoken the truth, but soon after he will have
 it that *Gorgonis sigillarem notam*, “the Medusa’s
 “head,” viz. the coagulating spirit has a share in
 the business. Whence also he inveighs against the
 schools, (h) because they recommended a palliative
 not a radical cure for the stone. *Si quidem non in-*
sudatum haftenus, nisi excludendo calculo jam facto:
fiendo autem, nullatenus obviam itum est: ut neque
impressionis, sive proclivitatis in calculum, extirpa-
tioni quicquam est consultum. “Since no method
 “has been hitherto attempted, but what has been
 “directed to the exclusion of the stone already
 “formed, and no steps in anywise taken to pre-
 “vent its forming, as no person has yet thought
 “of destroying the first impression and predispos-
 “ing cause of the stone.” Indeed it is true, it
 has sometimes happened, that persons have been
 obliged to submit to the operation twice, thrice,

(g) Ibid. p. 560. (h) Ibid. p. 557.

and even oftener. But it is also certain that many have passed their whole lives free from the stone, though cut for the stone in their infancy, and afterwards have arrived to mature old age. Indeed in those who are so unfortunate as to have stones frequently generated in the kidneys, these passing into the bladder, unless soon voided by the urinary passages, may again afford a basis for a stone in the bladder. Chemists are wont to boast of their specifics in this case; but it does not appear from any real fact, or experiment, that it is possible to cure this calculous diathesis. I have seen persons who voided stones almost every week: of such Aretæus has justly said: *Calculorum igitur procreationem ex foecunda sterilem reddere, nemo potest. Facilius enim est, uterum a pariendo prohibere, quam calculosos renes facere* (ἀλιθῆς) *ut sine calculis sint. Ad exitum quoquo modo procurandum auxilia quarendum sunt* (i).

“ No person therefore is able to render the pro-
 “ creation of stones, from fertile, sterile. For it
 “ is easier to prevent the womb from bearing;
 “ than cause kidneys subject to breed the stone,
 “ not to generate those concretions. We must
 “ endeavour to procure their expulsion in anywise
 “ from the body.” For no one is without the elementary principles of the stone, as they exist in the urine of even the healthiest persons; hence art cannot destroy the power of generating stones: yet many pass their whole lives free from this terrible disease, when the elementary principles of the stone, as yet dispersed throughout the urine, are evacuated from the body previous to their having formed an union with each other. But those in whose urine this union of the elementary particles happens in the body, are said to labour under a

(i) De curat. Morbor. diuturn, lib. 2. cap. 3. p. 130.

Lithiasis, and there is always danger of a stone's being formed in such persons, if the urine in the kidneys or bladder happens to meet with any indissoluble body, to which, as to a basis, the elementary particles of the stone may affix themselves. Such persons are extremely happy, if the concreted substances are evacuated from the body under the form of gravel or small stones: exercise, diluting liquors, and frequent making water, principally conduce to this intention. Hence also we learn, why calculous disorders often succeed, when persons, on account of a fractured limb, a fit of the gout, or the palsy, are forced to continue a length of time in an unactive state, who before, while they led an active life, were entirely free from these complaints: for which reason Sydenham, as has been mentioned before in the chapter on the gout, drank small beer for his supper to afford a vehicle for his urine, in hopes that if any thing was beginning to be collected in the urinary passages, it might by this means be washed away.

But although calculous concretions are very frequently found in the whole biliary organs, and in the parts through which the urine passes when it is evacuated, still there are great hopes remaining, that such concreted substances may make their way out of the body spontaneously, or if they are too large to be expelled by the natural passages, that a way for their exit may be prepared by art. Stones have been met with also in other places in the body, from whence they could not be expelled either spontaneously, or by the assistance of art; whence frequently disorders arise, of which it is scarcely possible, or at most extremely difficult, to form a diagnosis, and which it is impossible to cure. For it is to be observed, that in the text of this paragraph, no particular place in the body is described as the seat or receptacle of
the

the stone, but it is generally said, “where a body
“entirely undissolvable is lodged in any part of
“the body, a stony shell presently applies itself
“thereto, in a greater or less degree.” It is probable,
for the reasons which will be given hereafter, that
a greater quantity of the elementary principles of
the stone are to be found in the bile and urine,
and that they are easily united together through
the collection of these fluids, and their longer
stay in their respective cavities; in the mean while
numerous and certain observations teach, that the
elementary principles of the stone are also met
with in the other humours of the body.

In the chapter on the dropfy, we have already
shown that all the cavities of the body, both great
and small, exhale a certain fluid, which, unless it
is again taken up by the absorbent veins, stag-
nates, is accumulated, and causes a dropfy of the
part in which it is collected. If the abdomen, or
thorax of a living animal, is suddenly opened, a
vapour exhales, which has a manifest urinous
scent. The blood of an healthy man, or of any ani-
mal, received from an opened vein or artery into
a clean vessel, emits a vapour of a similar smell.
Whence it is judged, and not without reason, that
this vapour, striking the nostrils with an urinous
scent, contains the elementary principles of the
stone, as well as the urine. This suspicion is con-
firmed, because in those places of the body, which
are constantly fomented and moistened by this
exhaling fluid, stones are frequently found.

The ventricles of the brain in an healthful state
are filled with such a vapour: and Wepfer (k)
found in the body of a woman almost seventy
years of age, in the middle of the plexus choro-
ides a whitish, gypseous, rough, uneven stone, the

(k) Hist. Apoplect. p. 9.

size of a lupine, and saw others the size of large millet seeds, scattered here and there, in both parts of the plexus. In an old man above seventy, besides stones in the kidneys, and one in the gall bladder equal in size to a nutmeg, also a quantity of sand and smaller stones in the urinary bladder, a stone was found in the pineal gland, covered with a membrane (*l*). The pineal gland, as we read elsewhere, has been also found full of greenish stones (*m*). And indeed although according to Descartes, this particular part of the body is the seat of the soul, yet calculous concretions are frequently found there. Wepfer discovered (*n*) in the brain of a woman who was beheaded for the murder of her child, a white angular stone, larger than a lentile, and also some pellucid angular gravel, in the pineal gland. De Graaf (*o*) relates that he has seen above twenty times, in persons who have died both natural and violent deaths, stones in the pineal gland. The celebrated Guntz (*p*) whose premature death the Republic of Letters deservedly laments, in five persons deprived of their senses, found little stones in the pineal gland, of which he has given us a description, and at the same time has collected several observations of the same kind from other authors. I could easily add many others, for medical history abounds with such observations, but these are sufficient to prove that the very encephalon is not exempt from generating stones.

Neither the cavity of the breast, nor the viscera contained therein are free from this disease. In the chapter on consumptions, mention has been already made of persons who by coughing have

(*l*) Act Erudit. May 1688, p. 236. (*m*) *ibid.* June 1689, p. 311. (*n*) Hist. Cicut. Aquat. p. 116. (*o*) De Succo Pancreatic, p. 113. (*p*) Prolusio ad Panegyrim Medicam, etc. per totum,

voided stones, and from that cause have fell into a consumption, generally incurable.

Heister has sometimes found stones in the little blackish glandules which are situated near the branching of the *aspera arteria* (q). In a man who died of an asthma, *in angulo bifurcationis asperæ arteriæ adeoque inter ipsa bronchia, et arteriam pulmonalem calculus hæsit, pollicem magnus, oblongus, utrimque acuminatus, satis asper, substantiæ glandulosæ involutus* (r). “ In the angle of the bifurcation of the *aspera arteria*, and therefore between the bronchia and pulmonary artery, an oblong, rugged stone, pointed at both ends, and in size a thumb’s breadth, wrapped up in a glandular substance.” The celebrated professor indeed adds, *Qui tamen tunc, nec bronchia, nec arteriam pulmonalem, sive premendo, sive alio modo, in actione sua impediuisse nobis visus est.* “ Which however did not then appear to me, to have obstructed in their action the bronchia, or pulmonary artery, by pressure, or any other way.” But when during life the bifurcations of the *aspera arteria* were moved in respiration, and the pulmonary artery pressed on by the whole force of the right ventricle of the heart, and distended with blood, it seems extremely probable, that a stone tolerably large, rugged and pointed at each end, must have frequently disturbed and interrupted the action of these parts. But the stone was deposited without the lungs. In a young sailor who died of a consumption, a hard, rough, cubical stone, weighing about eight grains, was found between the left lobe of the lungs and the pleura, which was whole and found in every part, except in the place where the stone adhered ;

(q) Medic. und. Chirurg. Wahrnehm, p. 843. (r) Baader Observat. Medic. p. 159.

which appeared thickened and of a dark red colour (*s*). The corpse of an old soldier who, as supposed, had died suddenly, was brought to the hospital for dissection. All that could be learned with respect to his preceeding complaints, was, that during the last twelve days of his life, though still capable of his duty, he spit blood, and complained of a pain in his breast. The internal surface of the pericardium was almost wholly lined with a calculous substance, as hard and brittle as bone. The pericardium to the sight appeared ossified itself, having entirely lost its flexibility, though it still continued membranous, and was a little thickened, very closely investing the calculous shell that had grown to its internal surface. Nevertheless, in some particular places not covered with this calculous incrustation the pericardium was membranous. This incrustation, in one part was almost half a finger's breadth in thickness; in other places it was much thinner, and every where beset round with obtuse prickles, whence the surface of the pericardium was all over rough and rugged where this calculous incrustation adhered (*t*). But the incrustation adhered to the heart by the intervention of some very thick membranes, wrapped up in which it seemed extremely hairy, and made a very frightful appearance.

It seems still more amazing that the heart itself, never during life one moment in a quiescent state, should become stony. In the body of a drowned man, Kulm saw (*u*), in the left ventricle of the heart, near the valves of the pulmonary vein, a stone, half a finger's breadth long, and about one-fourth part as thick, fixed in the fleshy substance of the

(*s*) *Sinopei Parerga Medic.* p. 57. (*t*) *Ibid.* p. 51. (*u*) *Act. Erudit.* April. 1726, p. 184.

heart. In the body of a woman about fifty years of age who died of a dropfy, and a complication of disorders, the learned Velse (*w*), a physician at present in great practice and high esteem at the Hague in Holland, of whose industry and candour there cannot be the least doubt; he, I say, observed the following particulars: *In cordis thalamo sinistro, circa basin et supra valvulas mitrales, nec non in latitudine sinus venosi, itidem sinistri plus quam dimidia, assurgebat ordo sive series, calculorum majorum minorumque, colore subfuscorum, et duritiei summæ, juxta invicem dispositorum, et quasi inter se mutuo articulorum, qui, substantiæ fibrosæ partium illarum radices suas infixas habentes, velamentum illarum nervosum internum perforaverant, et intra cavum sinus venosi ejusdem porrigebantur nudi, in cuspidēs acutas et inequales terminati: ita ut ad ipsum illum calculosum ordinem manus adstricta sensum, veluti si ad ordinem acutorum in lupo pisce dentium fricaretur, ferme referret.* “ In the left sinus of the heart, towards its base, and above the mitral valves, as also throughout above one-half of the extent of the left venal sinus, arose a row or file of larger and lesser stones, of a brownish colour and very hard, placed close together, and as it were articulated with each other, which having their roots fixed into the fibrous substance of those parts, had perforated their internal nervous coat, and extended quite bare into the cavity of the venal sinus, terminating in acute and uneven points; so as that if a person’s hand was rubbed against this row of stones, they occasioned almost the same sensation, as if the hand had been rubbed across the sharp teeth of a large pike.” During the whole course of the distemper, sufficiently complicated, the respiration had been short, and very

(*w*) Dissert. Miscel. Anatom. pract. pag. 44.

difficult, attended with a very troublesome cough that yielded to no medicines. From the aliments taken into the stomach there was indeed an immediate danger of suffocation, but neither vomiting, nor indeed even an inclination to reach, ever ensued (*x*). She had complained of a deep-seated pain at the pit of the stomach.

Several histories of stones found in the heart, not only in the substance of this viscus but also in its ventricles, may be seen in Senac (*y*). This great man suspects indeed, and not without reason, that bony concretions are very often mistaken for stones in the heart, as such ossifications are frequently met with in this viscus. In the mean while he does not deny, that stones have been found in the heart, and on this occasion relates, that he himself saw in a child one half of the thorax entirely petrified.

In the month of October, 1747, a butcher at Vienna having slaughtered an ox, and feeling the heart larger and harder than usual, made an incision into it, and extracted a large stone; which he presently brought to me (for I make a practice of purchasing any thing curious that these people find in the entrails of beasts.) The stone resembled the figure of the cavity of the heart, it was yet bloody in the furrows, which were impressed all over its surface, from the fleshy fibres of the internal surface of the cavity of the heart, and part of the torn membranes still adhered to it. The ignorant butcher, having extracted the stone, cut the heart to pieces and threw it away; hence I had no opportunity of examining the heart itself. But he affirmed that the beast, before it was slaughtered, seemed to be in perfect health, and

(*x*) Ibid. pag. 42. (*y*) *Traité de la structure du coeur*, tom. II. pag. 428, etc.

that that he found nothing extraordinary in the other viscera which were perfectly sound. I remember a stone of the same sort was offered to another physician, by a butcher, some years ago.

Now if stones can be generated in the heart, perpetually in motion, and through the cavity and substance of which the blood is propelled with a great rapidity; it is the less wonderful that the same thing happens in the vessels through which the humours circulate. Tulpius was of opinion, that he first had described an unheard of species of stone, which, from the place where it grew, he called Arterial. For in the body of an apothecary's servant, who died after having long laboured under a complication of disorders, he found a stone in the branch of the aorta, which passes towards Eustachius's gland, situated over the left kidney: an exact drawing of which is annexed (z).

Disruperat autem calculi caput (ita appellamus rotundam illam excrescentiam, quæ cum angustiore collo haud male refert caput implumis pipionis) arteriæ tunicam, latitante reliquo corpore in dilatata ejus fistula. Sed ita, ut vulneris oræ minime hiarent, verum contraherentur tam arcte circa ipsius collum, ut vix guttula sanguinis potuerit illinc effluere. “ The head of

“ the stone had ruptured (so we call the round
“ excrescence, which with a narrower neck, not
“ badly resembles the head of an unfledged young
“ pidgeon) the coats of the artery, the rest of the
“ body lying in its dilated cavity, but in such a
“ manner, that the orifice of the wound in no wise
“ gaped, but was contracted so tightly round its
“ neck, that hardly a drop of blood could escape
“ from thence.” The part of the stone which
protruded beyond the artery was almost as hard as
flint: the part that was contained within the ca-

vity of the artery was softer. *Totus autem lapis referebat, ad amussim, implumem aviculam: lanci impositus ponderabat drachmas duas.* “ But the whole “ stone exactly resembled a little unfledged bird, “ and weighed exactly two drachms.” And as human *calculi* are generally light, this stone must have been of a tolerable size; though the greatest part of it was concealed in the artery, which naturally is small.

But what Pifo saw (a), who wrote before Tulpius, in the body of an old man, who had almost attained his hundredth year, and enjoyed a good state of health, except having an abscess in either kidney, is far more astonishing. *Thorace namque ejus aperto, aortam præter morem oppido dilatatam observavit non sine stupore, etc. Dissecta aorta, prope cor fistula quædam lapidea, instar tubuli veluti incrustans totum stipitem arteriæ, reperta fuit, extractaque, cum admiratione omnium; minime enim adhærescebat; alioque cineracei coloris, sed vitri, instar fragilis.* “ Upon opening the thorax, he “ observed, with astonishment, the aorta very “ much dilated beyond its usual size, etc. The “ aorta being laid open at a small distance from “ the heart, a kind of stony pipe was found, to “ the admiration of the bye-standers, which in- “ crusted the whole circumference of the ar- “ tery; and was extracted, for it did not adhere in “ the least; it was of an ash colour, but brittle “ as glass.” Tis true indeed, that the aorta, near the heart, is frequently found ossified in old people, and other long-lived animals, and no longer membranous; its coats being wholly, or in part, changed into bone: but our author particularly remarks, that this pipe indeed lined the aorta, but did not adhere thereto, as it could

(a) Observat. et. consil. de morbis a colluvie seros. pag. 315.
be

be extracted whole. Besides a greater brittleness was observed in this concretion, than is usual in bone; whence it is justly termed a stony substance.

We also read that stones have been found in the veins. But as the course of the blood thro' the veins is from a narrow place towards a wider, it seems strange, that a stone, beginning to concrete in a vein, is not forced away through the vein, always wider in its course, to the heart. Yet in the body of a boy who died of a violent fever (who though never healthy, had only during the last days of his illness, complained of a dysury) two stones were found in the emulgent veins near the kidneys (*b*), one in each vein. Thomas Bartholine is accounted by every body a man of the greatest understanding, and strictest honour; indeed he was not an eye-witness of this fact; for at the end of this case we find the following circumstance recorded: *Quemadmodum testis mihi est frater charissimus Doct. Erasmus Bartholinus, qui per D. Moretum, insignem Patavii mathematicum, a Brixiano medico hanc observationem accepit.* “As my brother Dr. “E. Bartholine assured me, who, by means of “Dr. Moret, a famous mathematician at Padua, “received this account from a Physician of Bres- “cia.”

That stones have been found in the *vena portarum*, seems less wonderful, since the venal blood returned from the abdominal viscera, is all conveyed into the trunk of the *vena portarum*, and from thence through converging canals, in the nature of arteries, flows into the liver. Tis true indeed, the motion of the fluids in the veins, is sometimes slow in weak and inactive persons, and thence an handle may be given for concretions; especially if any thing begins to adhere about the

(*b*) Bartholin. Hist. Anat. rarior, pag. 71.

valves of the veins, or the figure of the vein is changed from the compression of some adjacent tumour. However it is a certain fact, that stones are far more seldom generated in the veins, than in other parts of the body.

As the cavity of the *abdomen* is constantly bedewed with a thin exhaling fluid, which upon opening the abdomen of a living animal, strikes the organs of smelling with an urinous scent, it seems likely, that calculous concretions may be formed in the cavity of the thorax, pericardium, and other cavities. The celebrated Littre saw in the abdomen (*c*) of a dead body, a hard substance like cartilage, very smooth and extremely white, in length about a thumb's breadth and two lines, in width ten lines, and in thickness seven: it was of an oval shape, and no ways adherent. In the centre it contained a round stone, very smooth and white, equal in size to a middling pea. The cartilaginous coat seemed to be of the same nature as the included stone, and by degrees acquired the same stony hardness. That the vapour which exhales from the capillary arteries into the cavity of the *abdomen*, may induce an incrustation on any foreign indissoluble body, retained in the cavity of the belly, appears from a curious experiment. John Conrad Brunner made an incised wound in the right epigastric region of a young dog, through which he drew out the duodenum with the pancreas, and a portion of the omentum, and passed a needle and thread through it, close to the insertion of the pancreatic duct, which he tied tight, and beyond the knot, entirely cut off the pancreatic duct, with a portion of the pancreas and the omentum. The wound soon healed, and the dog recovered its former good health. About two

months after, the dog was poisoned with *cocculus indicus* and *nux vomica*, and immediately dissected, in order to discover whether the pancreatic duct had been rightly cut off. *Foris, ubi ductus pancreaticus inferebatur, atque abscissus fuit, filum sericeum adhuc constrictum reperit, cui arenulae albae accreverant (d).* “ On the outside, where
 “ the pancreatic duct was inserted, and had been
 “ cut off, he found the silken thread still tied
 “ tight, to which some grains of white gritty
 “ sand had concreted.”

Stones have also been frequently found in the hollow viscera of the abdomen, namely, the stomach and intestines. It has been already observed, in the chapter on the Hepatites and various kinds of Jaundice, that stones are often formed in the gall-bladder, through the dilated duct of which they pass into the duodenum, from thence into the other intestines, and are at last voided by the anus, as is frequently the case. But as this part of the duodenum into which the biliary duct opens, is not far from the pylorus, and violent fits of vomiting often happen at the time biliary stones are passing into the intestines, it does not seem impossible, that a stone lodged in the duodenum, should through such violent compressions of the abdominal muscles, be forced into the stomach through the pylorus.*

But properly we are not treating of stones formed in other parts, and afterwards conveyed into the stomach and bowels; it is clear from repeated observations, that the humours, which pass into the stomach and intestines, contain in them the elementary principles of the stone, which

(d) John. Jac. Wepfer Cicut. Aquat. Hist. pag. 202. etc.

* The Translator has himself been an eye witness to such a case.

apply themselves to any indissoluble substance, and grow thereon as on a basis, and thus form a stone sometimes of a great size. The celebrated Lanzoni, (*e*) in the body of a woman, who had long complained of a pain in her stomach, sickness, and want of appetite, and after having in vain consulted the most eminent physicians, died of a continual fever, found in the stomach ten stones, the largest of which weighed an ounce. However, although in this case no mention is made of the internal nuclei of these stones, and it might perhaps be doubted, whether biliary stones had not passed into the stomach; yet it deserves consideration, that in the account of the symptoms with which this poor woman was afflicted, there is not the least mention made of any such, as usually accompany the passage of biliary stones into the duodenum. Besides, biliary stones are usually very light, hence are large in comparison to their weight, and therefore it does not seem probable, that a stone weighing an ounce, could have passed from the duodenum through the pylorus into the cavity of the stomach. Whence although it should be granted, that these ten stones were originally biliary, yet that which weighed an ounce, must have acquired a considerable increase of bulk in the stomach; which in like manner would prove, that the origin of the calculous concretion resided in the stomach. For it seems beyond doubt, that a biliary stone may afford a nucleus, to which the calculous matter may attach itself; since the elementary particles of the stone can attach themselves, and grow to any indissoluble body. We meet with the following observation in an eminent author, who has wrote extremely well on biliary concre-

(*e*) Acta. Physic. Med. etc. Natur. curios, Vol. 1. pag. 117.
tions:

tions: (f) A woman was thought to be afflicted with a nervous cholic, and made use of medicines proper for that disorder, from which she reaped some benefit. The symptoms afterwards changing, it was judged, that a stone was passing from the kidneys to the bladder; which diagnosis seemed to be confirmed by this circumstance, that after a few days she found relief, but also felt a weight about the lower part of her belly. After some interval of time, she was seized with a sudden violent inclination to go to stool, and the sensation of weight increased very much; at the same time she felt a violent pain in the middle of the gut *rectum*; prodigious but useless efforts to go to stool next followed, attended with cold sweats, and faintings. She felt an hard body in the gut *rectum*, which catching hold of, and at the same time straining with all her force, it at length came away with the stool, and being examined by the physician present, was found to be a stone of the intestinal kind, containing in its centre for a nucleus a small biliary stone, round which the other calculous matter had grown.

Other indissoluble bodies also offering themselves in these parts have afforded nuclei for stones. Ruysch preserved in his cabinet (g) two stones, which an horse in the emperor's stables at Vienna had voided by stool, and were made a present of to him. In the space of six weeks this animal had voided by the anus thirty-six stones of different sizes.

The largest stone being broken to pieces, in its middle was found an oat. It is a known fact that grooms mix straw cut small with the oats which they give their horses, that these animals may be

(f) Coe on biliary concretions, pag. 137.
2. pag. 83.

(g) Thesaur,

obliged to chew the oats, which otherwise they would swallow whole. Without this precaution, these animals are frequently observed to languish and decay.

A girl twelve years of age, had for six years been afflicted with most acute pains in her belly, which returned by fits with extreme violence, and were increased from the use of acids, and meats of difficult digestion: these pains used to abate if the body was naturally open, or made so by means of laxative medicines or clysters. At length she was seized with a more excruciating fit of her disorder than she had hitherto experienced, attended with violent reachings and an obstinate costiveness. The famous Sympson (*b*) being called in, tried many things without success, so that for almost three weeks together the girl was in perpetual torment, and from pain and want of sleep and nourishment became totally emaciated, and resembled a skeleton, though before a wholesome fresh complexioned girl. When at length a cure of so obstinate a disease was almost despaired of, she began to vomit bile of a deep yellowish colour; she was advised to drink plentifully of warm water, and frequently; which she readily did. After having vomited six or seven times, she had a plentiful stool, and felt an hard substance pass through the anus, which, upon examination, proved to be a stone of an irregular cubical shape, four thumbs breadth in circumference, and which weighed five drachms. In the centre was a plumb stone, to which the calculous matter had concreted in layers; as is shewn in the plate annexed. Sympson had predicted to the girl's friends an abatement of her pains, after the evacuation of this substance,

(*b*) Medical Essays, Tom. 1. pag. 301.

though perhaps sometimes flighter pains would still return, until the parts distended, and compressed by this weight, recovered their natural tone. But though she eat whatever came in her way, nay, such things which before certainly caused her pains to return, yet the event was answerable to his prediction.

A boy eating sheep's and lamb's trotters greedily, swallowed some of the small bones; he languished in a shocking manner for six years, being afflicted with frequent pains in his bowels; nor during the whole period did he grow in the least. Three stony balls being extracted from his anus with a pair of forceps, and two others being voided by stool, he got rid of all his complaints, and in a short time recovered his health, strength, and grew bigger. Upon breaking some of these stones, a bare little bone was found to be the nucleus. (i) The celebrated Alexander Monro relates several cases in the same place, which prove that such calculous concretions are formed in the stomach and bowels. The similar observations, that are to be met with in Coe, merit also a reading (k).

Whence it appears how imprudently those persons act, who swallow stones of fruit, bones, and the like, which cannot be digested in the stomach and bowels. But this is easily avoided if a person chuses it: there are however other things which may afford a basis for intestinal stones, yet cannot always be avoided. For observations teach, that indurated excrements, retained long in the great intestines, have been covered over with a stony incrustation, and have grown to a great size. Such a stone was extracted, which weighed two ounces, two drachms and an half, and being light in pro-

(i) Essays and Observations physical and literary, vol. 11. pag. 345, etc. (k) On Biliary Concretions, pag. 137.

portion to its bulk, was so large that it could not be extracted with the forceps, till several incisions had been previously made in different parts of the anus (*l*). In the middle it contained indurated excrement, to which various layers of stone had concreted, as may be seen in the plates, which represent the stone whole, and divided through the middle. This woman had lived ten years in the greatest misery, but the stone being extracted, she was perfectly cured in a month's time. The stone is preserved in the cabinet of Mr. Morand, who also extracted a stone of equal size, from the anus of another person with the forceps, without making any incisions, as in the preceeding case, being able to break the stone with the forceps while lodged in the intestine, and extract it in pieces (*m*). A piece of the stone is exhibited to view in the same plates, by which it appears, to have been formed of concentric lamina in like manner as the former stones. But what the nucleus was to which these layers of stones had adhered, is not shewn: perhaps it could not easily be discovered, as the stone was extracted piecemeal. I could instance many other similar cases, but I imagine these sufficiently prove, that stones have been found in every part of the alimentary canal.

Stones have also been found in the cavity of the uterus: we meet with a remarkable case in Hippocrates (*n*) of a young woman, who always suffered great pain in the conjugal intercourse, at other times was perfectly easy, and never became pregnant. But when she had arrived at her sixtieth year, after having made in the forenoon a plenti-

(*l*) Academie Royale de Chirurgie, tom. III. pag. 56.

(*m*) Ibid. tom. III. pag. 60. (*n*) Epidemic. v. textu 20 chart. tom. ix. pag. 340.

ful meal of leeks, in the afternoon she was seized with excruciating pains resembling labour pains. At length a pain came on that was infinitely more violent than any she had felt before: rising up from her seat she perceived something hard and rugged in the orifice of the womb, and fainting away herself, another woman extracted with her hand a rugged stone equal in size to the axis of a spindle; her pains instantly ceased, and she never after had the least return of her disorder.

From this observation it may naturally be deduced, that a stone, though perhaps of a lesser size at first, had been lodged forty years in the womb; for the patient in her youth, had felt violent pains during coition, and was full sixty years of age when she was at last freed from the stone.

The great Louis (*o*) has collected several cases of uterine stones, where he has also considered the opinion of a certain physician, who insisted that the stone mentioned by Hippocrates, did not come from the womb, but from the bladder. But he does not seem to have established his doctrine by arguments of sufficient weight, as Louis very justly observes.

A more recent observation communicated by the celebrated Gaubius to the Dutch society of Haarlem, affords an instance of uterine stones, that cannot possibly be objected to (*p*). A maiden twenty years of age had for twelve years laboured under a *prolapsus uteri*, “a bearing down” of the womb,” which she affirmed had proceeded from a kick on her belly. The bearing down at first was small, but increasing by degrees, it at length projected above seven inches beyond the vagina, and the whole circumference of the

(*o*) Academie Royale de Chirurgie t. 11. p. 130, &c.

(*p*) Haarlemsche Maatschappij. t. 111. p. 604.

tumour measured thirteen inches ; at first, she could return the tumour into her body with her hand, but in the sequel that became impossible. A skilful surgeon, in consultation with others of the profession, advised only a palliative cure, with a very mild diet. By this advice the poor creature found great relief ; but she was suddenly seized with violent pains, resembling labour pains, that returned by intervals, and in an hour's time voided from the womb a large stone, the figure of which is described in the annexed plate. Hence she was greatly relieved, but the following day, her pains returned, and a larger stone endeavoured to force its passage : but as it could not pass the orifice of the womb, on account of its prodigious size, the surgeon was forced to make an incision into the superior part of the orifice of the womb to enlarge the passage. As soon as the stone came away, her pains intirely left her. However, she constantly voided a gritty matter. Having passed three or four years, without the least complaint in making water, after the voiding of these two stones she was seized with a kind of stranguery. On the ninth or tenth day after the attack, she felt the same kind of pains as before, but without any effect. Three weeks after the expulsion of these two stones, she went to a church, about three miles distant from her place of residence, to return thanks to God for the benefit she had received. On her return home, her pains again increased, and she voided several small stones, and a quantity of calculous matter. In about a month's time, her pains returned very violently, and she voided two stones, which together weighed six drachms, and also a quantity of bloody matter. About the space of a quarter of an hour, intervened between the expulsion of each stone. The patient then seemed better than she had been
for

for three whole years ; was intirely free from pain, and could walk tolerably well. But the bearing down of the womb, seemed rather increased in size, than lessened.

The smallest of the two stones that were first voided, weighed an ounce and five drachms, the largest two ounces and half a drachm, and thus all the four together weighed exactly four ounces, three drachms and an half. They all consisted of a whitish ash coloured substance like chalk : the external surface was covered with a yellowish brown incrustation, brittle, which had fallen off in several places. In other respects, as is usually observed in stones of the bladder, they were composed of thin laminæ mutually laid over each other. The substance of uterine stones was also found white, and as it were chalky, in those cases which are related in the Memoirs of the Royal Academy of surgery.

Stones have also been found in the parts connected with the uterus. De Graaf speaking of the Fallopian tubes (*q*) uses the following words : *In foliaceo hoc tubarum ornamento quandoque Hydatides accrescunt : vidimus quoque, singulis ejus extremitatibus calculos durissimos adhaerere, quos una cum ornamento illo etiamnum conservamus.* “ In “ this fringelike or foliaceous ornament of the “ tubes, hydatids are sometimes formed : I have “ seen also in each of its extremities very hard “ stones lodged, which together with the “ bria itself I preserve in my cabinet.”

These instances are, in my opinion, sufficient to prove, that there is scarcely any part of the body in which stones have not sometimes been found. I could easily relate many more, (for medical history abounds in such.) Thus stones have

(*q*) De Mulierum organis, s. xiv. p. 230.

been found in the mouth, tongue, nose, ears, liver, spleen, &c. but lest I should seem too tedious, I have only briefly mentioned these cases.

The subject matter of the stone has occasioned much dispute. Galen (r) took it for granted, *calculos illis in corporibus procreari, in quibus humorum crassamentum igneo calore concretum fuerit*. “ That
 “ stones were generated in those bodies, in which
 “ the sediment of the humours was concreted by
 “ a violent heat.” Whence he imagined the stone was most frequent in children, because they are voracious, more hot, and void thick urine; *quod crassamentum si consistat et accumuletur, quum decenti tempore non excernatur, et intus copiosum maneat, cogitur concrefcitque*. *Hoc autem orto principio, residuum crassum, quodcumque in vesicam appellat, isti adhaerescit, creaturque calculus*. “ Because if the
 “ dregs settle and accumulate, from their not being evacuated in proper time, and remain within the body in any quantity, they become thick and concrete. This beginning thus once made, attracts to itself whatever thick matter may be contained in the bladder, adheres thereto, and a stone is formed.” Afterwards, the whole medical school adopted Galen’s opinion, and endeavoured to confirm it by various arguments. They saw the mucus of the nostrils by drying form pretty hard scales, which sometimes could not be wiped off without difficulty: they observed, that sometimes like substances were brought up by coughing from the lungs; hence they judged the inspissation of mucus, especially by the greater heat of the whole body, or only that of the kidneys and bladder, was altogether sufficient to account for the generation of stones in

(r) Comment. in text. vi. lib. 111. Epidem. Chart. t. ix. p. 128.

the human body. On which account, they recommended to their patients to be careful not to heat the kidneys, by lying too warm, or exposing themselves to the heat of the sun, or of a fire: nay many imagined, it was sufficient to produce the stone, if a person sat at table with his back turned towards the fire. But mucous concretions soften in water, and in time wholly dissolve therein; which stones do not, but however must do, if they consisted of inspissated mucus.

Others observing that cheese was prepared from fluid milk, which by age became extremely hard, deduced from thence the origin of the stone, and therefore strictly forbade persons, in whom they apprehended danger of a stone's being formed, the use of milk and cheese. But cheese though ever so hard, is softened and melted by heat, as well as the horns of animals, grows soft by being macerated in water, and is dissolved if boiled; which is not the case with the stone. Besides, in oxen and horses, which never fed on milk or cheese; stones have been found of prodigious size. Denys declares (s) that he has cut a great many persons for the stone, who had never tasted a bit of cheese. He extracted two stones from the urethras of children, which had only lived upon their mother's breast. Nay, as he remarks in the same paragraph, a stone was extracted from a new born infant; which certainly had never tasted cheese, or even breast milk. Indeed as has already been observed, when we treated of the diseases of pregnant and puerperal women, it is not improbable, but a little milk may flow to the uterus during the last months of pregnancy, and conduce to the nourishment of the foetus; but it does not hence follow, that the origin of the

(s) Heelkundige Aanmerkingen over den Steen, p. 97.

stone which was lodged in the body of the fœtus, even during its residence in its mother's womb, can possibly be attributed to the cheesy particles contained in this small quantity of milk.

It is certain indeed, that calculous disorders are very common in Holland, from the testimonies of Ruyfch, (*t*) Denys (*u*) and many others; and it is likewise certain, that the Dutch are very fond of cheese, and salted, smoaked, and dried flesh and fish; and that many physicians have ascribed the frequency of the stone to this diet. But Denys (*w*) who lived seven years in the East Indies, has observed that very few calculous patients are found in that hot country. He was surprised, that in the large and very populous city of Batavia, the celebrated emporium of the Indies, to which, exclusive of the great number of Dutch, people of all nations resort, he could find in seven years only two patients who were obliged to submit to undergo the operation of Lithotomy. Yet a great quantity of cheese is imported into this city, and the Dutch, who come there from Europe, live upon the hardest bread, cheese, and salt provisions, for eight, nine, or more successive months. Upon their arrival in India they persist in eating salted and dried fish, and other salt provisions, to which they generally add acid, or very heating sauces. They also make an improper use of an abundance of unripe fruits, which they pickle with salt, vinegar, and the hottest spices. The water they drink, flowing from the neighbouring mountains, is impregnated with earthy and stony particles. Yet notwithstanding such a diet, which is by no means to be com-

(*t*) Observat. Anatom. Chirurg. p. 1. (*u*) In the place above quoted, p. 96. (*w*) Heelkundige Aanmerkingen, &c. p. 95.

mended, very few of the numerous inhabitants are afflicted with the stone.

Moreover he has remarked, that more calculous patients, in proportion to the number of the inhabitants, are found in some cities than in others; nay further, that more calculous patients are to be met with in a particular quarter of the same city, than in all the rest.

Nevertheless, they all live upon the same diet. He has observed, those who dwell on the sea coasts, are less subject to this disease than other people (*x*). He thinks for this reason, in those places where fresh water abounds, the inhabitants use it in cooking their victuals, and for their drink. But the Dutch very seldom drink water, being accustomed to beer from their earliest infancy. Besides, the law directs, that the water used for brewing, shall be brought from some place distant from the cities, that the fæculencies may subside, and thus the water may be drawn off perfectly clear for this use. And almost every house has a well, with a pump erected over it, from which the water used to boil the victuals of the family, may very conveniently be pumped up, which water is generally pretty good, especially if it is a gravelly or sandy soil, as is not seldom the case, through which the water is filtered, and thus comes into the well pure and limpid. They also very carefully collect rain-water, which they principally use for their cookery, and for making tea and coffee; which many of them drink to excess, and enervate their bodies by these hot, aqueous, drinks. Whence every housekeeper, except the very poorest, has two pumps in his kitchen, one of which supplies the family with rain, the other with pump water.

(*x*) Heelkundige Aanmerkingen over den steen, pag. 96, 97.

'Tis true indeed, more poor than rich persons are afflicted with the stone: and also that they often are in want of these conveniencies of life. But as many of the poor, at least among the Dutch, are necessitated to get their livelihood by sedentary employments, perhaps it may be owing to that cause, since, as has been already mentioned, and as will hereafter be proved, rest of body favours the generation of the stone.

It must not however be concealed, that women, who usually lead more sedentary lives than men, are more seldom afflicted with the stone, at least in the bladder. Denys (y) learned from his own experience, that forty men were under a necessity of undergoing the operation, while only one woman had occasion for the assistance of a surgeon to extract a stone from her bladder. But the shortness of the urethra, the straightness of its passage, and its greater width in the female sex, afford an easier exit to those which are lodged in the bladder. It is certain women are seldom troubled with the stone in the bladder: but they are as frequently, if not oftener, afflicted with nephritic disorders, stones in the kidneys and in the gall bladder, than men, as I have observed myself; and I have repeatedly heard the same from other physicians of undoubted veracity.

But children also are very subject to the stone; though naturally active, and fond of motion; for when awake, they never sit still, unless compelled thereto against their inclination, by their schoolmaster: it certainly merits consideration, that during the first part of their lives, in consequence of a very bad custom, they are usually bound tight with rollers round the body; whence the kidneys are easily compressed, and the free secretion and

excretion of the urine obstructed. And at this age, if they are in health, they are almost always asleep, almost always lie in cradles. These bandages are commonly applied in such a manner that the lower parts of the body may be conveniently kept clean from the urine and fæces; the upper part of the abdomen and back remains always bound tight round with a roller. Hence frequently, in the very first months of life, the groundwork is laid of a stone; which afterwards lodging in the bladder, encreases in size, and cannot be extracted without having recourse to the operation. Denys extracted very hard stones from the urethras of children, and was obliged to perform the operation of lithotomy on a boy only two years of age, from whom he extracted a very hard stone (z).

The reason why the children of poor people more frequently are afflicted with the stone than others, seems to be this: the parents are forced to work hard to maintain their families; therefore cannot bestow much time in nursing their children, and leave them a great while together in the cradle; which that they may bear quietly, and not disturb the whole house with their cries, they give them diacodion, and other similar opiates, which require the dose to be increased by degrees, or they lose their effect. Thus these poor little things lie night and day in a stupid, drowsy, languid state, till it suits the mother to clean them, and give them food. The women who nurse the children of the wealthy, frequently presume to act in the same manner, unless prevented by the vigilance of the parents. When they are a little older, begin to learn to walk, and of course cannot be made to lie so long together,

(z) Ibid. pag. 97, 98.

the mothers set them all day upon perforated chairs, that they may have time for their necessary employments; and thus the poor children, deprived of all exercise, become rickety, bandy legged, and are rendered incapable of moving, as will be shewn hereafter. Then, from the perpetual inaction of the body, they easily become calculous.

The constant use of water impregnated with terrene, calcarious, stony particles, is usually reckoned one of the causes of the stone. It is a known fact, that in many parts of the habitable world, there are caves from the tops of which a very limpid water slowly drops, which soon concretes into hard stone, whence large striæ hang down from the roof, over which the water running enlarges their size, and if it reaches the ground in a fluid state, there in like manner soon grows hard, unites with the pendulous striæ from the roof, and thus often forms wonderful figures, sometimes as beautiful as if they had been formed by the hand of the sculptor: but frequently wholly monstrous and also heterogeneous; which is not surprising. There is such a cavern in the mountains of Styria, which is accurately and faithfully described, by the great Nagel, mathematician to the emperor of Germany, who by command, and at the expence of his Imperial majesty, made many, and indeed long and painful journies, with a view to enrich and illustrate natural history. From drinking such waters, calculous concretions in the human body seem to be apprehended by many, as they so quickly petrify. But at least among the Dutch, though the stone is very common in Holland, no such waters are drank, and in the *primæ viæ* especially, there seems no reason to apprehend any ill consequences from drinking such water; also upon a chemical examination such concretions
yield

yield pure water, which drawn off, a dry fixed earth is left in the bottom of the retort: human stones, and those of other animals, chemically examined, yield very different products; as will appear in the sequel; whence the origin of the stone cannot be deduced from this cause.

Hales (*a*) to whom the medical art is so greatly indebted for his many excellent discoveries, has remarked, that in some places, the water commonly used, when boiled, incrustates the vessel with a kind of stony matter, and indeed so much, that in the space of two years, an incrustation half an inch thick, adhered to the sides and bottom of a vessel, this had every day been made use of for this purpose. He also has observed, that this substance is deposited in the bottom of a vessel, and affixed all round the sides, as tartar usually is, and hence he calls it tartareous. And as at Paris, the water incrustates the pipes through which it is conveyed, in such a manner, as in process of time entirely to plug them up, he assigns this as the reason why the Parisians are more afflicted with the stone in the bladder, than the inhabitants of any other city: it is true indeed that lithotomy is frequently performed at Paris: but this city is the metropolis of the whole kingdom, to which a vast number of persons resort, as well foreigners, as natives who have been brought up in the different provinces of France. Besides, the fame of its surgeons is the cause why a great many calculous patients come to this metropolis to seek relief, who had long been afflicted with the stone, before they ever drank the water of the Seine.

(*a*) Hæmastatics on the animal calculus, Experiment x. page 236.

(b) When Olaus Borrichius visited the dreadful natural cavern, near the city of Wells, in Somersetshire, called Okey hole, he was amazed at the pendulous striæ which had been formed from clear, insipid water, slowly dripping and gradually petrified; and enquired of the neighbouring inhabitants, *anne calculi dolores sentirent vicini; quod rivus, mediam illam rupem subterlabens, potum ministraret incolis: responderunt, se multo minus affligi calculo, quam quamvis aliam in Anglia gentem. Quin imo sustinebant affirmare, illam ipsam antri hujus Trophoniani lympham, si potetur, calculos, et praesertim arenulas, largiter exigere; in stranguria autem non ea aliud praesentius esse remedium.* “Whether they were much afflicted with the stone, as the water of the river which ran through the middle of this rock was universally drank by the neighbours: they returned for answer, that they were much seldomer afflicted with the stone than any other people throughout England. Nay, further, they persisted in affirming, that the water of this Tryphonian cave if drank, powerfully expelled stones and especially gravel; and that it effectually and quickly cured the stranguery.” The same has been since confirmed by others (c). It is well known, that the Caroline hot baths quickly incrustate with an hard stony matter, whatever bodies are immersed therein. Yet nobody is afraid to drink these waters in a large quantity; nay they are extolled by many, for their lithontriptic virtue; of which we shall speak further at § 1428.

Besides, water is seldom found that contains no heterogenous matter, or when boiled in a kettle, does not incrustate the vessel more or less with

(b) T. Bartholine. Epist. Cent. iv. pag. 476. (c) Boerhaave Chem. tom. 1. pag. 607.

a kind of tartareous substance that sticks to the sides and bottom: whence if the stone proceeded from this cause, calculous patients would be far more numerous. It is to be remarked also, that such waters, being deprived of this earthy, and as it were tartareous matter, by being boiled, are less likely to produce similar concretions in the body. Therefore such waters would be more likely to prove injurious if drank cold. But from what has been just mentioned, it appears, that water strongly impregnated with such particles may be safely drank cold. It has already been observed, that the Dutch are very frequently afflicted with the stone, who yet never, or very seldom, drink water. They use water for brewing, or pour it in a boiling state, on tea, or roasted coffee berries, and drink the liquor warm: but in both cases the water has already deposited in the kettle, the substance supposed to be the material cause of the stone.

Upon thoroughly considering all the phenomena that are observed in the urine of the healthiest person, of which we have already treated, it seems, as if the original cause of the stone is not received into the human body, but naturally exists in the fluids of the most healthy. This matter of a future stone, while it continues divided as it were into its elementary principles, in no respect injures the human body, disorders none of its functions: it is only capable of doing mischief, when its elements, united together, concrete; otherwise it spontaneously passes out of the body; and thus we all void stone with our urine, but separated into its minutest constituent particles, which will soon concrete to whatever indissoluble body they chance to meet: hence the matter of the stone is not something degenerating from an healthy state, but inseparable from perfect health, and always existing

in the habit. For the experiments of Nuck, and the observations already recited, demonstrate that if in an healthy person or animal, an indissoluble body be introduced into the bladder, a stone is instantly formed, and, when once formed, quickly grows larger. If this solid indissoluble body be removed, the production of the stone ceases. When a person is freed from the stone in the bladder, by the operation of lithotomy, in his childhood, he continues his whole life free from this disorder, unless another indissoluble body again comes into the bladder; viz. a renal stone, a clot of coagulated blood, or any thing of the like kind. It is a fact, that persons cut for the stone seldom suffer a relapse, even if they live to extreme old age.

The stone is therefore a production of the human body; and hence belongs to the animal kingdom; and chemically examined, as will be mentioned hereafter, affords the same products, as bones, nails, horns, hair, hides, *etc.* of animals. From this consideration the excellent Lobb concluded (*d*). *Vehementer calculo et podagra vexatos, omnino victus animali abstinere debere*: “that persons violently
“afflicted with the stone and gout, ought entirely
“to abstain from animal food.” Because the flesh of all animals contains all the constituent substances of the gout and stone; namely, animal alkali, animal oil, air, and earth. But it seems deserving of notice, that the human body, from the joint actions of the viscera and vessels, possesses the property of changing the aliment into its own nature, and of wholly divesting it of its former properties. Whence, though an healthy person should live entirely upon a vegetable diet, yet the elementary particles of the stone would exist in his urine; and his hair, nails, *etc.* if distilled, would

(*d*) Treatise on the Gout and Stone, page 127.

yield the products of animal bodies, not of vegetables, though he had wholly lived on these last. The horns, hoofs, *etc.* of oxen, horses, *etc.* by distillation yield an animal volatile salt, and animal oil, though oxen and horses live wholly on vegetables.

Neither are these animals exempt from the stone; as has been already demonstrated. A boy two months old voided two stones, one smaller, the other the size of a middling pea. (*e*) Now at this age children are fed with breast milk, or pap, each of which is a kind of vegetable food.

It appeared before at § 76. and the following sections, where we have treated of *diseases from a spontaneous alkali*, that animal food disposes our juices to putridity more than vegetable food. The celebrated Hales has remarked, (*f*) that a greater quantity of calculous matter separates from the urine when it is verging towards putridity; and in this respect, a diet composed of acid vegetables may prove serviceable to calculous subjects. It does not seem however, that an immunity from the stone, or a diminution of the stone already formed, can be promised from such a diet; as in healthy urine, the elementary principles of the stone begin to unite long before it grows putrescent, which therefore will concrete to the stone already formed, and increase its bulk. The only advantage that can be expected from a vegetable diet, is that the urine thereby less disposed to putridity, may deposit less calculous matter within a given time, and thus the stone be more slowly enlarged; an effect by no means contemptible. But what may be expected from diet, with respect

(*e*) Lautter Hist. Medic. Morbor. Rural, pag. 11. (*f*) Hæmastatics on the human calculus, pag. 218.

to the dissolution of the stone will be hereafter considered at § 1428.

(g) We learn from physiology, that through the constant circulation of the fluids, and also through the action of the muscles, small particles are of necessity worn off the solids, and when thus abraded are mixed with the fluids, circulate with them, and are expelled from the body; whence the living body would be soon destroyed, unless by nutrition as many similar particles were daily restored to the body, as are destroyed and lost by the very actions of life. Thus the whole cuticle (*b*) every where and perpetually scales off, perishes, and is regenerated, the abraded particles of the vessels and bones also quickly grow again in every part. When a plaister spread on black silk, is applied to a slight cut on a finger, we observe in a day or two the silk worn into little holes: the same circumstance would certainly happen to the cuticle and skin, if the parts destroyed were not constantly restored by nutrition.

The like loss of abraded parts, and restoration of those lost, happens in those places of the body, which are secure from all external attrition. At § 1261. where we treated of the chalk or lime stones of gouty persons, mention has been already made, of the curious experiments that were instituted to demonstrate the singular property of madder, which stains the bones of animals red, and only tinges the earthy substance, that enters into the fabrick of bones; whence neither the cartilages acquire a red colour from the use of madder before they become ossified, nor even the callus that unites broken bones, until it begins to assume the nature of bone. And it appears from

(g) Boerhaave Institut. Medic. § 435.

(b) *ibid.* § 476.

the experiments of the celebrated Du Hamel that the red colour which bones acquire from the use of madder, vanishes in the space of six weeks, if the animal is no longer fed with that vegetable. For the stained particles are successively abraded, in the place of which others succeed that are not stained. Nay, when he alternately added madder to the victuals of a young hog, he observed in the thigh bone of this animal cut asunder, red circles placed alternately. Whence it seems evident, that the substance of the bones is worn away and renewed, though they are securely defended from all external attrition. If therefore this happens in so hard a part of the body, viz. the bones, the same must come to pass in other parts, the constituent particles of which cohere together less firmly.

The matter which supplies the place of the abraded parts, is brought to these places by the vessels in a fluid state; and as the abraded parts are of a similar nature, they also are returned with the fluids through the vessels in a liquid form. Otherwise this solid dust would be accumulated in the part from which it had been abraded, and soon disorder the functions of the body.

These elements of the solid parts of the body which conduced to the purposes of health, now unfit to answer that end, and worn off the part to which they adhered, are separated by the vital powers, and expelled the body: perhaps the whole body would at length grow rigid and incapable of motion, unless these particles, now useless to health, were evacuated.

May not these when degenerated from disease, and incapable of returning with the fluids through the veins into the circulation, if accumulated in the part from which they were abraded, form gouty chalk or lime stones, exostoses, etc? To-

phaceous tumours are undoubtedly often found in the viscera, which contain a kind of chalky matter.

But since these abraded elements of the solid parts are mixed with the fluids, are returned by the veins, and are unfit for the purposes of life, which they had heretofore answered, their expulsion from the body becomes necessary. This is brought about by the same means whereby those things are naturally evacuated, which would prove injurious to health if they were longer retained in the body; namely by urine, stool, and the exhalant vessels which are plentifully distributed over the whole surface of the body, both internal and external.

Indeed stones are most frequently found in the biliary organs, which open into the intestines, and in the places where the urine is secreted, through which it passes and wherein it is collected. Whether or not does the exhalant fluid, which passes off through the pores of the skin, and like dew humectates the greater and lesser cavities of the body, contain also the elementary principles of the stone? It seems so from the preceding observations. The surface of the pericardium was encrusted with a stony substance; stones have been observed in the cavity of the thorax, and the cavity of the abdomen, adherent to no particular part; the whole middle part of the thorax has been found petrified. The perspirable matter quickly evaporates, nor does it remain long enough in the cutaneous vessels, to afford the elementary principles of the stone an opportunity to unite together, whence such concretions can seldom be formed there. Nevertheless we read that even this happened (*i*) to a gentleman, *qui*,

(*i*) Bartholine, Hist. Anatom. rar. Cent. 1. Observat. xxxiv. pag. 54.

calculo et arthritidi, domesticis hospitibus, saepe obnoxius, subinde in largissimum sudorem solvebatur, quo non serum exsudabat, aut sucti per poros liquores, sed, quod mireris, manipuli arenularum, quas inducta manu abstergebat. Quotidianum id nobili viro, et a medicis saluti illius excubantibus visum persaepe; testis mihi est fide dignissimus Olaus Wormius. “ Who
 “ was subject to the stone, and gout, pretty con-
 “ stant companions, oftentimes fell into profuse
 “ sweats, in which serum, or the usual fluids,
 “ did not exsude through the pores, but what is
 “ astonishing, handfulls of gritty sand which he
 “ wiped off with his hands. This happened al-
 “ most daily, and was frequently seen by a
 “ gentleman and the physicians to whom he
 “ entrusted the care of his health, as Olaus Wor-
 “ mius, a person of the strictest integrity, has
 “ assured me.”

Since therefore the elementary principles of the stone are contained in all urine, even in that of the healthiest person, and the abraded parts of the solids of the body may be evacuated by urine, mixed with the excrementitious juices, the cause of the stone seems not without reason ascribed thereto; seeing that those elements may unite together, which before their union flowed in the urine. And therefore the matter of stone would nearly approach the nature of bone. This seems confirmed by many circumstances. The most eminent physicians allow a great affinity between gouty lime or chalk, and the stone, nay some call those concreted substances, gout stones, which are extracted from the joints and indurated parts in that disease when inveterate; as has been observed in the chapter on the gout. It was there also remarked, that aqua fortis, or spirit of nitre dissolve the earthy part in bones, which being taken away, they become meer cartilages. Spirit
 of

of nitre also entirely dissolves the stone in the bladder. Besides, Denys (*k*) found very frequently stones, called calcarious, white or ash coloured, and brittle, but he observed that such stones grew faster than others, and on the contrary those which were hard, solid, and heavy, grew far more slowly. If the teeth are disordered, a calculous incrustation grows upon them, frequently so hard that it cannot be broken off without using force, and a sharp steel instrument; I saw in a girl, who had neglected this stony incrustation at its first appearance, and afterwards when grown larger would not suffer it to be removed, being foolishly afraid of instruments, all the teeth, particularly those of the under jaw, so incrustated that they resembled one entire lump, a shocking spectacle, which an able surgeon was obliged to cut away with a steel chisel, and a leaden mallet. Which being done, and the mouth thoroughly cleansed, a most intolerable offensive breath was soon removed, on account of which the poor girl had been almost wholly deprived of the comforts of society.

As the solid parts of the body, though extremely hard, are worn away by the unavoidable actions of an healthy life, the abraded parts, now rendered useless to the human body, require to be evacuated: whence a quantity of such particles must be contained in the excrementitious humours, which if they circulated with the fluids in a state of separation, till they passed out of the body, would do no mischief; but should they concrete together might cause the stone.

It appears in § 21. where we have treated of the diseases of the *simple solid fibre*, that the minutest fibres, which by means of a very fine

(*k*) Aanmerkingen over den steen, etc. pag. 93, 94.

aqueous and oleaginous glue united to each other, constitute the larger solid parts, are of an earthy nature. Whence stones will abound in earth; which a chemical analysis confirms. Quere, Do brittle stones, called calcarious, concrete when the earth is predominant beyond the other constituent principles? For stones do not consist of earth alone, nor do the excrementitious fluids evacuate from the body the abraded parts only, but also water, salts, and oil, which by the heat of the body and constant circulation are rendered acrid, and would prove injurious if retained in the constitution. Now according to the different nature of these salts and oils, and the different proportions in which they are mixed, the concreted substances formed from their union may be of various kinds.

Thus we perceive in different urines gravel concrete of different colours, white, yellowish, red, and sometimes black. Nay, in the same person, at different periods, the gravel concreting in the urine has been found of different colours. Sometimes likewise stones are met with of a variegated colour; nor have all the circles of which a large stone is composed the same colour; just as more or less oil intervenes, or something else is intermixed. But mankind also differ in every visible part, in colour, thickness, and height: we see the solid stamina of our bodies in the nails and hair, in which many solid concretes appear. But what a diversity do we meet with of colour and solidity therein!

Since therefore the matter of the stone may consist of the elements of the fluids and solids of our body, which have conduced to the offices of life, which have been parts of our body, which at length, rendered unfit for life, are abraded by the vital motion and separated, the reason appears

pears evident, why such a diversity is observed in stones, according to the different matter they have admitted in their first formation, or the different proportions in which their constituent parts have been mixed together.

It seems worth while to consider, how the stone concreted from these may act; and also what accurate observations, and a chemical analysis have discovered in stones.

Boyle in his excellent treatise, intitled Medical Hydrostatics (l) has examined the specific weight of the human calculus to water, and found it was always heavier than water; indeed he perceived the weight different in different stones; but so as that it was nearly equal to twice the weight of a quantity of water of the same bulk. He observed the same in the stones taken from other animals called Bezoar. Nay he made use of this specific weight as a criterion, to distinguish genuine from counterfeit Bezoar; and dissuaded a person from purchasing such a stone, because the owner would not submit the stone to an hydrostatical examination, although it had every appearance of being genuine (m). Whence he says; *In omnibus his exemplis observare licet, animales illos lapides, non aequantes duplicatum pondus aquae aequalis ipsis quoad molem, continere minus gravitatis specificae fere quinta parte, quam veri fossiles lapides, cujusmodi est chrystallus, quae quinta parte ipsis specificè gravior est.* “ From all these instances we may observe, that
 “ animal calculi which do not weigh double the
 “ weight of a quantity of water of equal bulk
 “ with themselves, contain less specific gravity
 “ by almost a fifth part than true fossil stones,
 “ such as chrystal, which is specifically heavier
 “ by one fifth part.” I know indeed stones are

(l) Boyle's Medical Hydrostatics, page 19 & 66. (m) *ibid.* page 11.

shewn in cabinets, as extracted from the human bladder, which equal flint in hardness and specific weight, and many such have also been offered to me at different times. But the truth of the matter is very doubtful. Bartholine attests, that he had in his museum a stone of like hardness, (n) which was said to have been taken out of an human bladder, but does not presume himself to affirm the fact for certain: *In his enim, aliisque, stamus donantium fide et relatione, quam sine offensa in dubium vocare non audemus.* “ For in
 “ these, and other matters, we depend on the re-
 “ lation and veracity of the donors, which we
 “ cannot presume to call in question without giv-
 “ ing offence.” It is certain, there have been notorious impositions of this kind. Several stones were sent from Jutland to the king of Denmark, (o) which were very large and hard, very much resembling flint stones, and were reported to have been voided by a boy. The king commanded the boy to be sent for, and ordered him to be confined in a castle, and to be strictly watched. *Sed, quanquam ita edoctus puer aliquoties convulsiones simulasset praevias, nihil tamen successit, nec ullum calculum excrevit, quia remotis amicis suis custodiebatur. Hinc cognita impostura, singulari serenissimi regis clementia, puer dimissus, et artificio honesto traditus est.* “ But although the boy so instructed
 “ sometimes counterfeited the previous convul-
 “ sions, yet nothing followed, nor did he void a
 “ single stone, because he was kept at a distance
 “ from his friends. Hence the imposture being
 “ discovered, by the singular clemency of his
 “ royal majesty, the boy was dismissed out of
 “ custody, and put apprentice to a good trade.”

Being sent for to a woman prodigiously swelled with the dropsy, as she was in the prime of life,

(n) Epist. Medic. pag. 510.

(o) Ibid. pag. 453.

and her strength as yet good, I prescribed the operation of tapping; but she would by no means consent, saying she was sure she should be cured without any human assistance. The reason she gave for her assertion, was that without taking any medicines she voided stones with her urine almost every day, without feeling the least pain. As she found me hard of belief, with respect to this story, she ordered a box to be fetched in which she kept a great number of these excreted stones. I examined every one of them, and found nothing but flints of various sizes, bits of marble, and pieces of brick, such as are found in the highways in abundance. I asked whether she never felt these stones come away when she was making water. She replied no; nor was she surprized at it, as these stones did not appear in the urine when first made, but an hour or two after were found in the bottom of the chamber pot. A wicked servant maid hypocritically pretending to be very devout, had persuaded her silly mistress, that it was owing to her earnest prayers to the Almighty, that she had got rid of the stones without the least pain, and that she was certain the dropsey also would yield to her prayers. The mistress incited her by presents to pray still more fervently. But although the imposition was so ridiculous and manifest, I could not prevail on this lady to make use of her senses; and thus she at length died of the dropsey.

It is too well known, that a set of vagabonds have audaciously presumed to undertake the very difficult and dangerous operation of Lithotomy: such fellows, in order to conceal their ignorance and villainy, have frequently substituted stones and flints for human calculi, which they have impudently boasted they have extracted by the operation from the bladder. Nay some-

times

times such artful impostors have been able to persuade the unhappy patient and the by-standers, that they have extracted a flint stone from the human bladder. A villain thus imposed on a Danish nobleman Hugh Lutzovius, as Paul Barbette, who flourished in the last age in Holland, wrote word to Thomas Bartholine; for the fellow had substituted a flint stone in the room of an human calculus (*p*). An honest and able Lithotomist had before pronounced, that this patient had a stone in the bladder, but that it was a small one: hence Barbette would not make him uneasy by informing him of this disagreeable truth, *sperans, illum nebulonem calculum quidem extraxisse, sed magnum pro parvo supposuisse*. “In hopes the scoundrel had really extracted a stone, and only substituted „ a large for a small one.” The noble Lutzovius returned back to Copenhagen, shewed the stone to Bartholine, and asked his opinion of the matter, as a great many persons had judged it to be factitious (*q*). Bartholine acknowledges, that *non ovum ovo sit similis, quam iste calculus pyriti, adeo ut et scintillae inde elicerentur, et cotis vice esse posset*, “not one egg was more like another, than “this stone was like a marchasite, insomuch that “it would strike fire, and might be used instead “of a whetstone.” However he did not venture to affirm it supposititious; because he recollected to have read a similar case in Schenkus, and kept in his museum himself such a stone, which a friend, who made him the present, had told him was extracted from an human bladder. Hence Bartholine was dubious, and prudently suspended his judgment, especially as the noble patient avowed that he had found great relief in consequence of the operation, and had performed a long journey

(*p*) Epistol. Medic. Cent. iv. pag. 451. (*q*) *ibid.* pag. 452. with

with very little inconvenience: besides the attendants affirmed, they were present at the operation. Nay, the noble patient himself was so thoroughly satisfied of the honour and dexterity of this villain, though he was at present afflicted with the same complaints as before the operation, that he firmly believed he had not been in any respect imposed on, but was persuaded that one stone had been extracted, and there was still another left behind; as he remembered another Lithotomist had told him, that he had two stones in his bladder. About a year afterwards, the impostures of this artful cheat were detected, who to escape his deserts privately decamped; and the noble Lutзовius, intrusted himself to the care of the able Lithotomist Francis Collet; who by the operation extracted two stones from his bladder, the biggest of which weighed two ounces and seven drachms; the other two ounces and as many drachms (*r*).

From this history it is plain what ought to be thought of those extreme hard calculi, altogether resembling flint or stone, which are sometimes met with in the cabinets of the curious. A remarkable case may be read of a woman of Berne (*s*), which was communicated to the Royal Society of London by Sigismund Konig, physician to the hospital at Berne, in Switzerland. In this woman the menses were wholly suppressed, she was afflicted with very acute pains in various parts of the body successively, and blisters the breadth of the palm of an hand, distended with a limpid water, and attended with great heat, suddenly broke out on different parts, and unless they were soon dried up, became so extremely painful, as to take away her senses. For the cure of these

(*r*) Ibid. pag. 510, 511. (*s*) Philosophical transactions abridged, Vol. iii. pag. 167, etc.

complaints, a salivation by mercury was prescribed, and indeed with this effect, that the patient continued in good health for almost ten months; when her former eruptions began to return again. The physicians determined on a second salivation, and while they were preparing the patient's body for the operation, though no purgative medicine had been administered, the blisters and pains of a sudden entirely disappeared. But within five days after, a complication of disorders ensued: the loins, bladder, perinæum, and groins, were full of pain: her strength was entirely lost: she had constant reachings to vomit, and a retention of urine, accompanied with signs of inflammation, and a quick intermitting pulse.

After bleeding, and proper medicines had been prescribed, a clyster was thrown up, which in about a quarter of an hour was vomited up; and being repeated a second time was in like manner returned by the mouth, with about half an ounce of tophaceous little stones, but not the least excrement. She now vomited every thing she took, and at the same time brought up a quantity of stones as hard as flint, and bits of shell resembling white marble, and extremely hard. A clyster being again thrown up and returned by the mouth, the quantity of stones was increased, and as the former were small as pease, these were equal in size to small filberts, and she soon vomited larger. The woman led a most abstemious life for four months, rejecting every kind of aliment. As her urine was frequently suppressed, the catheter was introduced every third day to draw off the urine; and as she was costive, a solution of sal polychrest in water was prescribed: the physician sitting by her bed side two hours, gave her six ounces of the above solution every quarter of an hour, and by stopping her mouth

with his hand prevented its being vomited up; and in consequence of its being retained in the stomach, the patient had a stool composed of excessive hard excrements, that distended the anus to such a degree as to endanger a rupture of the part, her appetite then returned. She had a stool every fifth or sixth day afterwards, her reachings returning at intervals, so that stones were now voided upwards and downwards of such a size, that frequently one or two of them weighed two drachms a piece and above, several of which, says the author, I have still in my possession. Her menses afterwards returned, and the fiery eruptions made their appearance as before; she now sometimes voided a rugged stone with her urine; and at last voided them by stool! By degrees she recovered her health, and was capable of following her usual employment; continuing a vast deal better than she had been for some time before; but even at present now and then voids stones by the anus and urinary passages.

A physician chemically analysed these stones, and found their products similar to those which are extracted from human calculi. However, I entertain some doubt whether this analysis was accurately made, as from six ounces of these stones he had five ounces and two drachms of caput mortuum, hardly a scruple and an half of lixivial salt, and five drachms and an half of phlegm mixed with spirit and volatile salt, some portion thereof adhering to the sides of the receiver. Thus the products collected in the receiver, together with the remaining caput mortuum, taken together, were exactly equal to the weight of the stones, which had been used in this experiment. But all chemists, who have examined the parts of animals and vegetables by fire, remark that a considerable portion evaporates into the air, and

cannot

cannot be retained in any vessels; hence the products collected in the receiver, together with the caput mortuum, are never equal to the weight of the animal or vegetable substance so analysed by fire. Besides, as will hereafter be shown, air constitutes a great part of the substance of the human calculus, it therefore seems wholly impossible, that nothing of the original weight should have been lost in these experiments.

Two of the stones voided by the above woman were sent to the Royal Society of London, by Sigismond Konig, and the famous Slare (*) examining them hydrostatically, found the specific weight of these stones to water to be as 217 to 100, and therefore above double the usual weight of stones and flints. He then examined a stalactites, which is gradually petrified from water slowly dripping through the clefts of rocks, and found its specific weight to water to be as 219 to 100. Whence he suspected there was a great affinity between these stones and the stalactites, as their specific weight so little differed. Besides he also made other experiments, which seemed to prove that these amazing concretes came nearer the nature of stones than of human calculi. This suspicion was confirmed, for the history of this wonderful disorder mentions, that the woman had drank large quantities of water, which possibly might have been impregnated with such a substance.

As the chemical analysis made by Konig was not satisfactory, Slare put one of these stones beaten into gross powder, into a coated retort, which he exposed during some hours to the naked fire, and indeed so violent a fire that it melted

(*) The Philosophical Transactions abridged, vol. iii. p. 176, 177.

glafs: three or four drops of a fluid came over, that resembled rectified spirit of hartshorn, and emitted the same smell. Whence he justly concluded, these concretes were animal substances, which however afforded far less animal principles, than human calculi, or those extracted from other animals, usually do: whence also a greater quantity of caput mortuum was left behind in the retort. This is evident from the analysis of human calculi (*t*). What could be the reason then, that these calculous concretes, voided by this woman, were so heavy? Was any foreign substance that was different from the animal matter, mixed therewith? Or had they approached nearer to the nature of bones? It has been already said, that it seems highly probable that the abraded parts of the solids of the body, now become useless to life, afford the matter of the stone. The specific weight of bones with respect to water, is as two to one: hence these concretes seem from their weight to have had a greater resemblance to bones: but they afforded in distillation a far less quantity of volatile parts, than bones yield (*u*): however they exhibited, even in an intense fire, more fixed earth, than human calculi.

We hence may also conclude, that there is just reason to suspect an imposition when stones are offered to us as extracted from the human body, which greatly exceed the specific and usual weight of human calculi. However it does not seem absolutely ascertained, that this never happens, witness the case just recited. For this woman, confined in an hospital, examined every day by that experienced physician Konig, and others, obliged to keep her bed several months, could not have procured stones and flints to carry on the impos-

(*t*) Ibid. p. 181.(*u*) Ibid. p. 181.

ture: nor could she have feigned those exquisitely painful blisters which arose in different parts of her body, nor have counterfeited the suppression of urine, for which there was a necessity of introducing the catheter so often; nor the viscid mucus that obstructed the neck of the bladder, nor the vast quantity of urine, that sometimes came away in the presence of the physician, &c. Besides, the concretes which were voided both upwards and downwards, on a chemical analysis, yielded products, that prove they were of the animal kind. It behoves the prudent physician to suspend his opinion in doubtful matters; but it is by no means right to deny every thing, the reason whereof is not immediately apparent. The specific gravity of human calculi is various; biliary stones are very much lighter than others; they sometimes have been found so light, as at first to float upon the surface of water, though afterwards they sunk to the bottom. Moreover, stones of the bladder have been observed to differ in their specific weight: however for the most part, the specific weight of the human calculus to water, has been found to be as five to four (*w*).

In the human stones of any size, that I have been permitted to examine and break to pieces, (and I have examined many) I always observed a nucleus or kernel in the centre, as has been before mentioned) to which the different lamellæ or coats had concreted, almost in the same manner as an onion is composed of concentric circles, in the midst of which the bud of the plant is fixed; whence the stone seems to encrease in growth by the successive application of a similar matter. These incrustations are observed not always to be of the same thickness; whence we may

conclude that the urine does not always contain the same quantity of calculous matter, or at least does not deposit it in the same plenty; and apply it to the forming stone (x). Hales is of the same opinion, and thinks, that when the urine for some time deposits less calculous matter, the surface of the stone is rendered more smooth by rolling about in the cavity of the bladder, and from the pressure of the bladder in its state of contraction. But when afterwards the urine deposits the calculous matter in great plenty, a fresh incrustation is formed; and thus a calculous lamella or coat is again laid over another smooth surface; to which however it less firmly adheres. (y) This he thinks is the reason, why the human calculus is easily separated into lamellæ. He imagines too, that the more acrimonious and high coloured the urine is, the greater quantity of calculous matter it contains: and therefore judges that the stone grows faster in the summer than in the winter season.

Human calculi are of various shapes, as may be seen in large hospitals where numbers of them are collected. If they compleatly fill the cavity in which they are lodged, they assume its shape. Thus I have seen a large stone, that perfectly resembled the figure of the bladder with its neck. So stones are met with, which exactly resemble the shape of the pelvis of the kidney and its branches; I have seen some myself, and figures of such are to be seen in almost every author. If several are lodged in the same place, from the pressure, and rubbing against one another they frequently assume strange shapes. I have sometimes seen the round extremity of one

(x) Ibid. pag. 178. (y) Haemastatics on the animal calculus, experiment, viii. pag. 226.

stone lodged in a deep cavity sunk in another, so as to form no bad representation of the articulation of the thighbone. But where there is only a single stone in the bladder, it is more frequently round than oblong.

From the preceeding argument, we evidently perceive, that calculous concretions are composed of animal principles; which is likewise confirmed by the chemical analysis of these substances. Helmont (z) who is fond of new coined words, calls human calculi Dualech, of which he thus writes: *Exfectum Dualech distillavi per se, nec quicquam elicui, praeter spiritum faetidum urinae, et flavum crystallum, simulque oleum quale ex desiccata urina trahitur. Quod autem in fundo mihi remansit, terra aerat nigra, ambusta, friabilis, et insipida.* “ I “ have distilled the human calculus by itself, but “ could not obtain from it any thing besides a foetid “ urinous spirit, a yellow salt, and likewise an “ oil, such as is extracted from desiccated urine. “ There remained in the bottom of the retort, a “ blackish, burnt, friable, insipid earth.”

The celebrated Frederic Hoffman examined chemically human renal calculi of various shapes, colour, size, solidity and weight, taken from different subjects; and the result of his experiments was as follows. (a)

He placed a renal stone that weighed three grains upon a burning coal, it soon lost its yellow colour and turned black, and immediately emitted a strong smell of volatile salt without any visible smoak, and almost wholly consumed away, only a litile black matter being left, which was perfectly insipid, and caused no effervescence upon the addition of spirit of salt. He threw

(z) De Lithiasi, pag. 684.
pag. 230, etc.

(a) Observat. Physico chem,

into the fire as much as would lie upon the point of a knife of these calculi reduced into fine powder; the whole room was presently filled with a foetid volatile scent, such as usually proceeds from burnt horn.

The powder of these stones when boiled in water rendered it white and turbid; the water inspissated by a gentle heat, left behind it a dry whitish substance of a salt bitterish taste: but this matter laid upon burning coals, emitted no smell, nor effervesced with an acid spirit, nor mixed with salt of tartar yielded the scent of volatile salt. The powder left after boiling, being dried, diffused its former volatile foetid smell while burning, to such a degree as to affect the noses of the whole company.

On some whole stones equal in size to coriander seeds, he poured spirits of vitriol; and upon some others in another glass spirit of salt; but they did not dissolve, little bubbles only were raised on their surface. Good aqua fortis being poured on them in the proportion of three times their weight, caused an intense effervescence and instantly dissolved the stones; as did also strong spirit of nitre, but with a still greater effervescence. The turbid whitish solution seemed rather thicker, which when fully saturated with oil of tartar per deliquium, effervesced, but nothing precipitated: this mixture was of a yellowish colour, transparent, and had a strong nitrous taste.

From all which circumstances it appears, that renal calculi contain neither fixed alkaline salt, nor stony or calcareous earth, but a volatile alkaline salt such as is extracted from animal substances.

Hoffman asserts (b) *nullam pinguedinem, vel oleosum aut sulphureum principium, calculorum mixturam ingredi; hoc ex eo colligimus, quod non flammam concipiunt, nec crassum vaporem emittunt, neque etiam per distillationem, quod novimus ab aliis tentatum, quidquam olei largiuntur.* “No fat, oily or ful-

“phureous principles enter into the composition
“of calculi; this I infer from their not catching
“fire, or emitting a thick smoak; neither do they
“by distillation, which I have known tried by
“others, yield any oil.” But Hoffman did not

make this analysis himself. Hence greater credit ought to be paid to those, who describe what they have seen with their own eyes. Slare (c) analysed

a great many human stones, and from his account it appears, that oil enters into their composition.

He distilled an ounce weight of human calculi lately extracted from the body, in a retort; there

came over into the receiver two drachms of a brownish spirit (so called), which more nearly re-

sembled spirit of hartshorn than spirit of urine: now chemists know for certain, that this brown

colour is owing to the oil which always adheres in distillation to volatile alkaline salt, and rising

with it dissolved in the phlegm, constitutes the spirit, so called, of hartshorn, urine, etc.

Whence also chemists, to purify the volatile salts extracted from animal substances, usually add

chalk, and then sublime these salts, which easily rise with a gentle heat in a tall vessel, and thus all

the oil that adhered to the salts, incapable of being elevated by so gentle an heat, is left behind in the

chalk: by this method these volatile salts are rendered extremely pure, and freed from their former

empyreumatic foetid scent.

(b) Ibid. pag. 232. (c) The philosophical transactions abridged, Vol. iii. pag. 179, etc.

He afterwards distilled in an open and pretty intense fire, another human calculus that weighed two ounces ; vapours came over, that condensed, afforded a solid salt, without any fluid. This salt was very brown, and of a bitter taste which he compares to the flavour of the empyreumatic oil of hartshorn.

Besides in the bottom of the retort was left a black coal or caput mortuum, which burnt in the open fire, emitted a thick smoak, until all the oil being consumed, nothing but a cinder was left. But we learn from chemistry, that oil alone affords food for fire, and that this last and fixed oil very strongly adheres to the earthly particles, nor can be forced therefrom without the assistance of fire acting in the open air. For how long soever the fire acts upon such a caput mortuum, in a luted vessel, a coal remains, which can never be reduced to ashes, unless the air have a free access to it. Hence it appears evident, that human calculi contain some portion of oil, as well as other solid parts of animals. The celebrated Hales, (*d*) a name of great authority in these matters found likewise, that oil was contained in human calculi, though in less quantity than in the blood or solid parts of animals. But he observed a greater quantity of oil in biliary stones, than in other human calculi ; which he ascribes to the inspissated bile that adheres to the external surface of these stones : but such stones often have inspissated bile for their nucleus, and are formed from bile, which contains a great quantity of oil in its composition.

He likewise found in biliary and other human calculi, that above one half of their fabrick con-

(*d*) Vegetable Statics, Analysis of the air, Exper. 77. pag. 188, etc.

sisted of air; nor could he ever extract, from any other animal, vegetable, or mineral body, so great a quantity of air. Who could have believed, that such a quantity of unelastic air was so firmly united to the other constituent parts of the stone, as not to be separated without a strong fire? But when this identical air freed from its former bonds recovers its elasticity, it fills a space, that is to the size of the stone in which it was contained, as 645 to one. It has been formerly remarked in § 647. where we treated of eructations and flatulences, that Hippocrates informs us, the bodies of men and other animals are nourished by three sorts of aliment; meat, drink, and air: and adds that the air which is in our bodies is called wind, that without our bodies, air. However, it is evident from Hales, that inelastic air is closely united to the constituent parts of the body, both solids and fluids, and that the same air freed from this union, by any means whatsoever, becomes again elastic. This great man conceived hopes, that a remedy might be discovered capable of dissolving this union of the air with the other constituent parts of the stone, (*e*) and thus the bulk of the whole stone be lessened by one half: and not only this, but that the air, now become elastic, in its exit from the stone, might disunite the other elementary parts of the stone, and thus destroy their cohesion; he drew this conclusion particularly from this circumstance, that by the same degree of fire, whereby the air is expelled, white vapours also rise, that condensed, afford an alkaline volatile salt; which therefore he suspects to have been intimately united with the air. Whether therefore, if the air could be separated from the stone

(*e*) Haemastatics on the animal calculus, Exper. 17. pag. 196.
while

while lodged in the human bladder, would the volatile salt exhale likewise, or not? Or, the air being extracted, would the other parts readily separate from each other, so that the stone falling into powder, might be easily washed away from the bladder by the urine? This only can with certainty be deduced from hence, that the stone would lose one half of its bulk, if all the fixed air could be extricated. But I shall say more on this subject hereafter at § 1428. where I propose treating of Lithontriptic medicines.

The famous Lister (*f*) laid down as an undoubted truth: *In omni aqua, certe dulci vel per se, vel marina mixta, succus lapideus, et vere metallicus, inest, fere ferreus, aut calcarius, ab utriusque metalli infinitam copiam, per omnia terrae viscera dispersam, ejusque vaporem sulphureum, si sit a pyrite, aeri commistum.* “ All water, at least fresh, either
 “ alone, or mixed with sea water, contains a
 “ stony and truly metallic juice, commonly fer-
 “ rugineous or calcarious, on account of the vast
 “ plenty of both these metals, diffused through-
 “ out the bowels of the earth, and their sulphu-
 “ reous vapour, be from a marchasite, mix-
 “ ed with the air.” Moreover, as he observed almost all calculi produced, out of the circulation of the blood, particularly in places where a stagnation of the juices took place, he hence concluded, that then such metallic or calcareous particles, before dispersed, united together by attraction, and formed such concretions in the human body; he then proceeds: *ad hujus rei fidem, olim coram societate regali Londinensi, ex humano calculo cremato metallum ferreum extraxi, magnete adhibito.* “ As a proof of this fact, I some time
 “ ago extracted iron from a burnt human cal-

(*f*) Dissert. de humoribus, cap. xxx. pag. 331, 332.

“ culus

“ culus with a loadstone, in the presence of the
“ Royal Society of London.” He therefore
thought that ferrugineous particles introduced into
the constitution, and intimately mixed with the
juices, conduced to the generation of the stone.
It is certain, that iron (g) *ubique fere pasci, ubique
quotidie consumi, sic prodire de terra, redire in
eadem. Quam facile ferrum solutum corpora homi-
num ingreditur, quam sæpe? cum acidis quotidie
tractatur, tractatum solvatur, solutum potetur.*
“ Grows almost every where, is daily consumed
“ every where, and thus comes out of the earth,
“ and returns to the same. How readily and
“ how often does iron in a dissolved state en-
“ ter the human body? it is daily corroded
“ by acids, when corroded dissolves, and the
“ solution may be drank.” Repeated experi-
ments have proved, that the ashes of vegetables
and animals contain particles that are attracted
by the loadstone. I am sensible indeed, that the
learned are greatly divided in their opinion con-
cerning the origin of the iron that is found in the
ashes of vegetables. Some have thought, that
these ferrugineous particles, did not exist in the
vegetable, previous to calcination, but were pro-
duced by calcination: the primary elements of
iron being in their opinion, earth, sulphur, and
acid salts, from which united by calcination, iron
might be produced during calcination which did
not exist before calcination. Others have main-
tained, that the iron which is found in these ashes
existed in the plant or animal, previous to calci-
nation, but as long as it continued mixed with
the other principles that constituted the plant or
animal, did not appear under the form of iron;

(g) Boerhaave Chem. vol. 2. pag. 447.

but these being dissipated by calcination, it resumed its real appearance.

The celebrated Gusman Galeatti (*b*) has endeavoured to put an end to this contest, by his own observations. He directed a quantity of vegetables to be burnt, that grew in the Bolognese, where no metals are found; and then a quantity of plants that grew on the Brescian mountains, famous for their mines of iron. He found upon a nice examination, that the ashes of the Brescian plants contained an hundred times more iron, than the ashes of those which grew in the Bolognese. Whence he concluded, that the iron, which he had collected from these ashes, existed in these plants before calcination, and was not produced in consequence of calcination. He found the same difference with respect to the quantity of iron, in the ashes of burnt animals, that had lived in these different places.

One circumstance however seemed to contradict this opinion, that in the ashes of human blood, dried, and burnt, this difference in the quantity of ferrugineous particles did not appear, though some of the persons, from whom the blood had been taken, lived in the Bolognese, and others in the iron mines of Brescia, or in the neighbourhood thereof. This observation had such weight with this candid gentleman, that he was about to change his opinion. But upon closely investigating the matter, he discovered, *metallicos illos homines, qui in Brixiensibus fodinis, aut prope fodinas, vitam agunt, cibis perpetuo vesci, non inde quæsit, sed longe advectis; similiterque aquas refugere, quæ ex illis scatebris, manant, sed aliis uti; quippe illas sine noxa sumi non putant.* “ That those miners
“ who lived in the Brescian mines, or in the

(*b*) Institut. Bonon. Tom. 11. pag. 109, etc.

“ neigh-

“ neighbourhood thereof, constantly lived upon
 “ food, not the produce of those parts, but
 “ fetched from a great distance; and likewise re-
 “ jected the water that flowed from those springs,
 “ and drank other water, being of opinion that
 “ those waters were hurtful.” Whence the rea-
 son plainly appears, why the same scarcity of fer-
 rugineous particles appeared in them all though
 they had lived in such widely different places.
 All these matters are in another place more largely
 explained. (i) The sediment of the urine dried
 and calcined, afforded more ferrugineous par-
 ticles, than the ashes of burnt blood. Moreover,
 from the information of Anthony Badia principal
 professor of practical physic in the university of
 Turin, he relates, (k) that such a quantity of ferru-
 gineous particles was found in the urine of an
 hysterical woman, that in the space of a day
 some ounces might be collected: but this woman
 had frequently taken a great many chalybeates,
 nay filings of iron themselves. He also adds
 another observation of a certain physician at
 Parma, which is still more surprising. Concern-
 ing his own experience he speaks thus: *Ego*
quoque, etsi in urinis hominum tantam ferri copiam
nunquam reperire potui, multas tamen hujusce me-
talli particulas observavi in sedimentis plurium urina-
rum, quas ex variis ægrotantibus collegeram, et co-
piosiores etiam in urinis cujusdam ex nostris medicis,
nephriticis doloribus sæpe obnoxii, eo ipso tempore, quo
ab hujusmodi cruciatibus vexabatur. “ I also, al-
 “ though I could never find so great a quantity
 “ of iron in human urine, yet have observed
 “ particles of this metal in the sediments of
 “ many urines, which I collected from different
 “ patients, and also in the greatest plenty in the

(i) Ibid. Tom. 11. pag. 20, etc.

(k) Ibid. pag. 37.

“ urine

“ urine of a physician of this place, very subject
 “ to nephritic pains, at the very time when he was
 “ afflicted with such complaints.”

Vincent Menghini (*l*) has demonstrated by curious experiments, made with the utmost accuracy, that ferrugineous particles exist in the blood of men and animals, and that they are chiefly found in the red part of the blood: and upon a fair computation, concludes, that twenty-five pounds of human blood, the quantity thought by Physiologists to circulate through the vessels of an healthy adult person; contain above seventy scruples of iron, or almost three ounces. He has also demonstrated by other experiments, (*m*) that the quantity of ferrugineous particles in the blood is increased, if iron, and especially iron ores are taken into the body with the aliment, which has been done without injuring health.

From all which circumstances it seems evident, that iron is contained in human blood, and in that of other animals; nay that it is to be found in the ashes of the solid parts, and in the sediment of the urine calcined; whence it is no wonder that such particles have been sometimes discovered in the human calculus. But do they always exist in the urine? Or are they in such plenty as to be capable of affording a basis for the stone, and of causing its hardness? Neither of these points seem to be ascertained.

We find among the experiments of Slare, that he applied a large and powerful loadstone to the *caput mortuum* remaining after the distillation of an human calculus, which attracted therefrom no ferrugineous particles: but from his account it ap-

(*l*) Ibid. pag. 245, etc.
 etc.

(*m*) Ibid. Tom. III. pag. 475,

pears that the loadstone was applied to the black coal adhering to the bottom of the retort. For the author himself observes, that this single experiment only remained to be tried, namely, whether after a reverberatory fire some ferrugineous particles might not be found in the residuum; since they likewise cannot be discovered in marcasites, though they contain great plenty of iron, till after calcination (*n*).

It has already been mentioned, that the antient physicians, and many others since, have deduced the origin of the stone from inspissated phlegmatic humours, by a greater degree of heat than natural, baked as it were to a stony hardness. But every thing that has been hitherto advanced, evidently proves this opinion inadmissible. Meanwhile it cannot be denied, but that a mucous or glutinous substance is to be found in the human calculus, which together with the other principles, concurs towards the formation of the stone, and by the interposition of which the cohesion of the rest is brought about, or encreased. It has already been observed at § 21. where we considered the most minute solid fibres, that the minutest elements of the solids, which seem to be earthy and most simple, by the interposition of an aqueous or fat glue, are so united to others, as to constitute the smallest solid fibre. Hence, as has been demonstrated, the stone consisting of the elementary principles of the solids of the body, abraded through the necessary actions of an healthy life, this glue, by the assistance of which those minute parts before cohered together, must of course have a share in the composition of the stone.

(*n*) Philosophical Transactions Abridged, Vol. III. pag. 178.

The little treatise of Benedict Stahl a physician at Basil in Switzerland (o) which cannot be too often read, contains very curious experiments, which prove, that such a glue exists both in flints and human calculi, as well as those of other animals, but indeed in greater quantity in these last. He found this glutinous matter to be elastic; and is of opinion, that the non-elastic air which Hales discovered in such plenty in calculi, is kept entangled by this glue. Whence he concludes, *1mo. Calculos animalium omnium maxime abundare materia elastica glutinosa. 2do. Materiam hanc elasticam aliquam analogiam habere cum illa, quam aqua ex seminibus cydoniorum elicere solet. 3o. Omnia ea, quæ aerem in hac materia elastica latentem in statum activum reducere valent, esse dissolventia calculi. (p)*

“ Firstly, that the calculi of all animals abound
 “ greatly in an elastic glutinous matter. Second-
 “ ly, that this elastic matter has some analogy with
 “ the mucilage, which is extracted by water
 “ from quince seeds. Thirdly, that whatever is
 “ capable of restoring the latent air in this elastic
 “ matter to a state of activity, is a real dissolvent
 “ of the stone.” Undoubtedly, at the time the particles of fixed air, approaching each other, recover their former elasticity, they must by their contact displace the parts between which they are lodged, and indeed forcibly, as it appears from Hales’s experiments that the non-elastic air latent in the human calculus, when it again becomes elastic, fills a space 645 times greater than that which the stone occupies in which it was contained. Hence, Stahl has deduced corollaries, which will prove of great use in the consideration of

(o) Epist. Eucharist. ad Danielelem Hartley, pag. 23. and throughout the whole treatise. (p) Ibid. pag. 33.

Lithontriptic medicines, which will be treated of at § 1428.

The last thing that deserves to be noticed in these calculous concretions, is, that they seem to have a great affinity to tartar of wine. One half of the human calculus, as has been said, consists of air; and the celebrated Hales (*q*) found such a quantity of air contained in the tartar of rhenish wine, that it amounted to one third of the weight of the tartar. And therefore, in this property, tartar very nearly resembles the human calculus. Air extricated from the human calculus, and from tartar, loses more of its elasticity in a few days, than such air expelled from other bodies (*r*). Rhenish tartar, if distilled, affords less oil, than seeds, and other solid parts of vegetables, treated in the same manner. A biliary stone in the space of seven days was dissolved in a lixivium of salt of tartar, in which also rhenish tartar dissolves. But stones of the kidneys and bladder will not dissolve in this menstruum. The human calculus dissolves in spirit of nitre, so also does tartar. Both these are dissolved in oil of tartar, but far more slowly. Moreover, tartar owes its origin to the most transparent pure wine: the human calculus to limpid healthy urine. Tartar is generated on the sides, and in every point of the surface of wine, the same also holds true of the stone: tartar is produced by a kind of orbicular incrustation, and the surface of it next the liquor is rough, that adjoining to the cask smooth: it is the same also with the stone. Tartar is hard and brittle, though it originally flowed in the clearest wine, and weighs far less than stones and flints:

(*q*) Vegetable Statics, Chart. vi. Experiment 73. pag. 178.

(*r*) Ibid. Experiment 73. pag. 189, etc. Haemastatics, pag. 194, 223.

The same holds good also with respect to the human calculus. Tartar cannot again be dissolved in wine, in which it concreted, though before it flowed in the wine: thus also the human stone, though it originally flowed in the urine, in a dissolved state, once concreted, will not again dissolve in urine.

Whence the celebrated Hales has been pleased to call the human calculus, animal tartar; thus it is very properly distinguished from tartar of wine, which belongs to the vegetable kingdom.

These circumstances, which respect the nature of the human calculus, in whatever part of the body it may be lodged, seemed in my opinion necessary to be premised. It next follows, that we consider those which have a connexion with the diagnosis, prognosis, and cure of the stone, when it is lodged in the kidneys, ureters, bladder of urine, or urethra. 'Tis true, that stones have been found in many other parts of the body, as appears from the foregoing observations; nay and are pretty frequently met with in the gall bladder, and liver; but these have been treated of in the chapter on the Hepatitis and various kinds of Jaundice. But where stones are lodged in other viscera, and parts of the body, certain diagnostic signs by which their presence might be known, are almost always wanting. Thus for instance, if the pericardium was spread over with a calculous incrustation, or stones were formed in the very substance of the heart or in its cavities, the action of the heart, would be disordered indeed, but it could not from thence be ascertained that a stone was lodged in that part. For numerous other causes might produce the same disorders; as polypous concretions, worms, an aneurism of the heart, or of the great vessels near the heart, etc: Whence indeed a probable suspicion of a

-latent

latent stone might arise, but never a certain diagnosis ! Nay, if we could be certain of the existence of stones in some viscera, unless they could be extracted by a surgical operation or be dissolved by some lithontriptic remedy, but little benefit would be reaped from thence. If a stone is lodged in the cavity of the uterus, there is a passage through which it may be evacuated spontaneously, or by the assistance of art ; but no such thing can be expected, if a stone is lodged in the pericardium, cavities of the heart, or its substance.

Whence it is sufficient to treat of stones in the kidneys and bladder ; where at the same time we shall have an opportunity of speaking of those remedies, which are extolled for their lithontriptic virtues.

S E C T. MCCCCXV.

IF this happens in the kidneys, from the earthy particles of the blood desiccated, it becomes a renal stone, principally taking its rise in the extremities of the arteries, under the form of sand.

From the blood that is carried to the kidneys by the emulgent arteries, the urine is secreted ; which, even in the healthiest persons, contains the elementary principles of the stone, as has been demonstrated. Therefore through the whole course of life, a fluid passes through the kidneys, that abounds with the elements of the stone, and from which they may be separated, especially if it is retained long in a state of stagnation, from any cause whatever. Nay it has been observed in the preceeding paragraph, that stones have concreted

in the very arteries of the kidneys. It was likewise remarked at the same time, that the elements of the stone quickly adhere to any indissoluble body, that they meet with in the parts of the body, where the urine is secreted, or collected when secreted. Hence blood, indissoluble from an inflammatory thickness, lodging in the extremities of the arteries, a little clot of extravasated and coagulated blood, a drop of inspissated matter, or of matter about to become inspissated, several small bits of gravel united together, as it were by crystallization, may form a basis or nucleus to which the elementary principles of the stone may adhere, and thus increase in bulk.

It was remarked before at § 1004, where we treated of the *nephritis* or stone in the kidneys, that in the kidneys are very minute follicles which seem to serve for the secretion of the urine; although there are also other secretory vessels, without the interposition of such follicles, immediately derived from the arteries. Now if very small grains of sand should begin to concrete in such follicles, through the membranes of the follicles being removed from mutual contact, the particles will not be united together, but will be dispersed through the whole substance of the kidneys. It was there also mentioned, that in the body of a deceased consul, who had been frequently afflicted with nephritic pains, and at last died of a consumption, the kidneys were found full of gravel; *ita ut, cum hinc inde parenchyma secaretur, quasi sabulum humidum scindi appareret*: “so that when the viscus was cut in different parts, it seemed like cutting so much wet gravel.” We shall not here examine further, the different opinions of anatomists, concerning the existence of these follicles in the kidneys; as it is sufficient for our present purpose, to know that the calculous matter may be

be separated and collected in the kidneys, whether this be done in follicles, in the extremities of the arteries, or in the secretory ducts themselves, that compose the greatest part of the renal papillæ. For, in dead bodies, gravel has been frequently found adhering to these papillae, and those corpuscles which are accounted follicles by many anatomists, are found especially in the outermost part of the kidneys, usually called the cortical substance. I have seen many renal calculi that had a small appendage, while the remaining part was of a spherical figure; as if the first concretion, resembling a stalk, had began in the excretory ducts, called the Bellinian tubes, the extremity of which projecting beyond such duct, by the continual apposition of fresh calculous matter, had acquired a spherical form. At this present time I have in my possession a renal stone that resembles a little flaggon, and from its very smooth and polished surface imitates the stones called Bezoar in the shops. I have seen several stones voided by the same man, after most excruciating nephritic fits; which were all smooth and shining on the surface, but of different shape and size.

It has been mentioned in the preceeding paragraph, that in healthy urine, kept in a clean glass, gravel indeed concretes, but never unites into a stone of any size: a few grains sometimes are joined together, but not firmly; and they every where adhere to the bottom and sides of the containing vessel: for they seem in this case be united together only by that power, whereby the elementary principles of the stone, dispersed throughout the urine, mutually attract each other. But where compression is added also, the small grains of gravel will be united more readily, and their cohesion be augmented; and thus they may be moulded as it were

into any form. For the semulgent artery is very large, has a strong pulsation, and quickly distributes its ramifications through the whole substance of the kidney. Nor is it very distant from the heart; whence the adjacent parts are compressed by the very diastole of the arteries. Without such a perpetual alternate pressure, it is difficult to conceive whence renal stones are sometimes voided so smooth and polished. This compressing power will be augmented, as the stone lodged in the kidneys encreases in size. But although the stony matter is capable of adhering to every indissoluble body, yet as is evident from what has been said in the preceding paragraph, the elementary particles of the stone most readily adhere to a stone already formed; which then quickly increases in its bulk. I have seen a man, who almost every month voided through the urinary passage, thirty, nay sometimes more stones of different sizes, among which I have seen some as big as small beans. He was sensible when the stones passed from the kidneys, but felt no great pain. He told me one day, he was certain he should void some stones in my presence, provided I would wait about a quarter of an hour. He accordingly performed his promise, and voided four stones before my face, that were as large as peas, and although one of these stuck near a minute in the urethra, he shewed no signs of pain, and helped to press it forward with his fingers. He was near sixty years of age, had lived a very irregular life, and drank great quantities of spirituous liquors. I advised him to live more temperately, and by degrees lessen the quantity of spirituous liquors that he drank: but he laughed at my advice, and replied, he would live as usual; perhaps thoroughly sensible, that he had a little mine of
stones

stones in his kidneys, but suffered so little inconvenience thereby, that he did not think it worth while, to change his way of living on that account.

The famous anatomist Bertin, who has given a very accurate description of the kidneys and their structure, which he has also illustrated by beautiful plates (s): remarks, that the larger ramifications of the emulgent artery are so distributed through the substance of the kidneys, that the pulsation of the arteries gently vibrates the urinary ducts, and promotes the expulsion of any substance that might begin to concrete and adhere to those vessels. He moreover observes, that the pelvis is vibrated by a double row of arteries, and thus if any gravel begins to adhere to the sides of the pelvis, it is thereby forced away into the ureter. As the same row of arteries is continued in the ureters, the same effect is produced there. But if the obstacle, adhering in these places, cannot be cleared away by the pulsations of the arteries, then the adhering mass will be gradually pressed more closely together, and condensed; which growing larger, the extremely sensible internal surface of the ureter, by the pulsation of the arteries, will be compressed against an hard stone; whence acute pain, especially if the stone is rugged and rough. Hence, the excellent author deduces the nephritic colic, and other symptoms, that happen when the stone from its size distends these parts, or injures their internal surface from its roughness and irregular shape.

In a person standing upright, the passage of the urine, secreted in the kidneys, through the ureters into the bladder, is perpendicular: in

(s) Academie des Sciences, 1744. pag. 116. and the following.

this situation therefore, both gravel and small stones, assisted by their own weight, can easily descend into the bladder, if they are less than the width of the ureter. But this is not the case when a man lies in a supine posture; whence the secreted urine will make a longer stay in the kidney, and the elementary principles of the stone may separate in the urine, while it yet remains in the pelvis of the kidney, or in the little funnels of the pelvis that receive the renal papillæ. I saw a man, who, never having had before the least calculous symptom, being under a necessity of keeping his bed for ten weeks on account of a broken thigh, within a few weeks after the fracture was cured, was seized with a nephritic cholic, and after having undergone great torment voided a rough stone, and during the remainder of his life was subject to the same disorder. From the same cause, gouty people are so often afflicted with the stone in the kidneys; as Sydenham observed in himself, and many others; as was mentioned in the *chapter on the gout*. Whence he advises, that such persons, instead of eating suppers, should drink an hearty draught of small beer, that the kidneys and ureters might as it were be washed clean by the increased secretion of a thinner and more aqueous urine.

Physicians in general agree, that continual lying in bed contributes to the formation of calculous concretions, or to their increase, if previously formed. From the opinion of the antients, they have given as a reason, because the kidneys were too much heated by constant lying in bed; whereby a mucous or pituitous matter lodging in the kidneys or their pelvis, was baked to the hardness of stone; whence also physicians advised persons, particularly those whom they judged inclined to the stone in the kidneys, not to stand too long
with

with their backs to the fire; which sometimes happened in great festivals. But in the preceding paragraph it has been demonstrated that the cause of the stone cannot be imputed to mucus inspissated by heat.

The celebrated Hales (*t*) has explained far better the reason why constant lying in bed favours the generation of the stone in the kidneys. While we lie in bed in an horizontal situation, the descent of the urine from the kidneys to the bladder, cannot be assisted by the action of gravity. While a person lies on the right or left side, the kidney of that side is lower than the bladder. If a man lies on his back, both kidneys are lower, or at least are not raised higher from an horizontal level, than the bladder; whence the urine may easily be accumulated in the pelvis of the kidney, and the elements of the stone separate from the urine, as also in the ureters. That in such a posture the urine may make its way into the urinary bladder, the expelling power of the kidneys, or the propelling power of the ureters must overcome the force of gravity, whilst the bladder is placed in an higher situation than the kidneys; and also the bladder, always contracted when empty, must distend itself, and remove the parts contiguous to the bladder: Whence it follows, that if the bladder is already full, the very urine collected in the pelvis and ureter must be forcibly pressed against the orifices of the vessels that secrete the urine. Thus therefore the progress of the urine into the bladder is retarded, and opportunity is given for gravel to concrete, not only in the pelvis of the kidney, but also in the Bellinian tubes; and hence gravel is often found in these after death. Whence it seems that the

(*t*) Haemastatics on the animal calculus, Exp. ix. pag. 228.

erect posture of the body is to be accounted one of the causes why a greater quantity of urine is secreted while we are awake, than during sleep. Hence Hales concludes, it would be better, if people would not lie in bed in an horizontal posture, but with the head and body raised, as soldiers lie in their barracks. Whence appears the utility of not always lying on the same side, lest one kidney remain always in a low situation, while the urine passes freely from the other, at that time placed higher, into the bladder.

Many people usually turn themselves from side to side while in bed, but others sleep so soundly that they never change their posture till they rise in the morning: however this more frequently happens in young, than grown persons. But we learn from experience that children are more frequently afflicted with the stone than adults, and therefore a greater number of children are obliged to undergo the operation of Lithotomy. Besides, children sleep more than grown persons, being swathed up cannot change the position of the body, and are left in cradles a long while together in an horizontal posture, or lying on one side. The mothers, if poor, frequently stupify the unhappy children by the constant use of opiates, that they may find leisure for their necessary employments in the day, and get rest at night. Moreover, Lithotomists in general agree, that they cut more children belonging to poor than to rich parents, because the children of the rich are usually taken better care of.

From all these circumstances it is evident, that the advice of the celebrated Hales concerning the best posture for sleep, is by no means to be slighted, as far as it respects the prevention of the formation of the stone in the kidneys. An horizontal posture may prove injurious by causing the
whole

whole abdominal viscera to press upon the kidneys; and there cannot be the least doubt, but this pressure may disturb the secretion and excretion of the urine. Very fat people generally are afflicted with the stone in the kidneys: for in such persons the kidneys lie buried as it were under a vast load of fat, as is daily seen in fat beasts slaughtered for food. In these, the vessels proceeding from the kidneys, and the pelvis, are every where surrounded with a great quantity of fat. In pregnant women the swelling uterus pressing against the intestines, and pushing them upwards and to each side, may prevent the kidneys, pelvis, and ureters from properly discharging their functions. It has been frequently observed, that women after their first lying-in have been subject to nephritic complaints, from which they always before had been free; especially if the womb containing twins, has been greatly distended. Piso has remarked, (u) *Ex centum nephritide laborantibus, octoginta et amplius renem sinistrum dolent, experientia teste*; "Experience teaches, that out of an hundred nephritic patients above eighty are affected in the left kidney." He thought indeed, that this happened, *Quod lien saburram ichorosam sanguinis atrabilarii in renem sinistrum repurgaret, potius quam in dextrum*, "because the spleen cleansed the ichorous filth of melancholic blood into the left kidney, rather than into the right;" on account of the proximity of its situation. For at the time Piso wrote, an opinion prevailed among physicians, that the spleen was the preparatory organ and receptacle of melancholic humours. Is it not perhaps more customary to lie on the left, than on the right side when sleeping? The celebrated Hoffman, as

(u) De Morbis e colluvie serosa ortis. Sect. iv. c. 2. p. 314.
has

has been observed at § 997. was of opinion that the left kidney was most frequently attacked by nephritic disorders, on account of the proximity of the flexure of the colon, often distended with hard excrement and wind, which therefore compressed the adjacent kidney. For which reason also, emollient clysters are so highly extolled in nephritic disorders, which promote the expulsion of wind, and indurated excrements, and thus free the adjacent kidneys from compression. It is a known fact, that the colon is only slightly incurvated on the right side, but on the left side makes a sigmoid flexure, which is the cause of the greater retardation in that kidney. 'Tis true indeed that a like sigmoid winding of the colon on the right side may be seen in the fifth figure of one of *Eustachius's tables* (w); but in the second and fourth figures, it appears only on the left side; and it is well known that Eustachius frequently used to delineate in his tables the common situation and figure of the different parts of the body, and likewise add other figures which exhibited the varieties which he had observed, though they more seldom occurred.

S E C T. MCCCCXVI.

WHICH by degrees increasing there, causes an obstruction in the kidney, chokes it up, and consumes its substance, expells it under the form of clotted blood, matter, caruncles, and bits of skin, and at last corrupts the whole, exciting bloody, purulent, fœtid urine; and frequently inflammation and ulceration of the adjacent parts.

(w) Tab. xi.

As long as the stone concreted in the kidney, continues small, and has neither a rough surface, or irregular shape, from which the substance of the kidney may be injured and irritated, it frequently is lodged there a considerable time without much inconvenience. Whence stones have so often been found in the kidneys after death, in subjects in whom there was not the least room to suspect their existence. But when a stone lodged there, from the same cause, which occasioned its first formation, proceeds to give disturbance, and its size may always be encreased, and from the accession of fresh calculous particles, that exist in the urine, the surface that was before smooth is become rough, and its spherical figure changed into an angular and irregular one; the substance of the kidney may be contused, compressed, obstructed, lacerated, inflamed, suppurated, and totally destroyed, as is apparent. Since a thorn sticking in the finger, is capable of producing a violent inflammation in the part, followed by suppuration, in consequence of which, the abscess afterwards bursting, the thorn is expelled together with the *pus*; we may easily comprehend, that the same consequence will ensue, when the substance of the kidneys is perpetually irritated by a sharp pricking stone. All these symptoms will necessarily be increased, when by the motion of the body, riding in a carriage, sneezing, or coughing, the kidney so affected, is shook, and rubbed against the stone.

It is no wonder therefore the substance of the kidney is thus wasted away by suppurating, that clots of coagulated blood are extravasated from the ruptured vessels, that part of the substance of the kidneys, either separated by *pus*, or abraded by the rugged stone, is expelled with the urine, under the form of little bits of flesh, or skin:

for

for it will hereafter be made evidently to appear, that the substance of the kidneys, when injured by a stone, may be disordered and corrupted in a surprising matter. Besides, the cellular membrane, it is well known, surrounds every vessel in the human body, insinuates itself between their minutest fibres, and when a suppuration comes on, is separated from the other parts, and upon the bursting of the abscess, is evacuated with the pus, under the form of little pellicles; sometimes large pieces of the cellular membrane issue out, when an abscess in the external parts of the body is opened by a surgeon. It is true indeed, the cellular web in the substance of the kidneys is thin; but in the history of inflammation it has appeared, that its seat is chiefly in the cellular membrane, which when inflamed it is capable of swelling prodigiously, and becomes very thick. A phlegmon arising on the back of the hand, where the cellular membrane is thin, a large tumour is sometimes formed, which suppurating, a large quantity of *pus* is collected? Whence the reason is evident, why, when a suppuration happens in the kidneys, bits of skin sometimes are voided with the urine.

Hippocrates also remarks, see § 1001. that from suppurated kidneys, thick particles are voided with the urine, resembling flesh; which he calls *σαρκία σπινδρά*, and says they come from the kidneys. Like particles also may be abraded by a rugged stone: Galen says: (x) *Sed certissima ulceratorum renum coniectura est, si cum urina exiguae quædam carunculæ excernantur, renum substantiæ partes, ob vehementem ulceris erosionem avulsæ.*
 “ But the most certain sign of ulcerated kidneys

(x) De locis affectis, Lib. vi. Cap. 111. Chart. Tom. vii. pag. 510.

“ is, if any small caruncles, part of the substance
“ of the kidneys, abraded by reason of the vio-
“ lent corrosiveness of the ulcer, are voided with
“ the urine.” Nor are such little caruncles only
abraded, but also sometimes far larger ones. Thus
it has been observed at § 1102, that sometimes
pieces of the kidney, as large as the top of a
man’s thumb, have been voided by the urethra
with extreme pain and anguish. In the same place
(see § 1002) observations may be read, which in-
form us, that fourteen pints of purulent matter
have been collected in a single kidney. Whence
it is evident, from such a quantity of purulent
matter, the whole substance of the kidney must
have been destroyed, so as that the external coat
only remained, but being very much thickened,
was able to contain such a quantity of accumu-
lated purulent matter without bursting. Eusta-
chius found the kidneys soft and putrid (y), and
relates many more excellent observations that con-
firm what has been just advanced.

There seems also another reason, why such ca-
runcles are abraded in disorders of the kidneys,
rather than of the other viscera. The great Haller
remarks, that the kidneys have papillæ, the num-
ber of which is not altogether certain, but there
are thirteen or more of them, nay sometimes
double or treble that number, have been seen.
These papillæ in the fœtus are so distinct, that
the kidney then appears to consist of as many dis-
tinct or smaller kidneys, as there are papillæ.
And these little kidneys have altogether the
same apparatus, as is seen in the kidney of an
adult. For every one of these is furnished with
its proper cortex of serpentine vessels, from whence
proceed the uriniferous ducts assembled together

(y) Opuscul. Anatom. de renibus, p. 120,

in a distinct bundle. In adults, the cellular substance being condensed, unites the renal portions and their papillæ into one smooth kidney; however it again almost recovers the condition which it had in the fœtus, if the intervening cellular membrane is relaxed by frequently injecting of water (z). Whence, when the substance of the kidney is macerated in a collection of purulent matter, or urine retained in the pelvis, in short, whatever the cause may be, such a mutual separation of the parts may be the consequence. Moreover, the extremities of the papillæ project beyond the rest of the substance of the kidney, and in the branches of the pelvis hang pendulous, and hence they may easily be injured and abraded by a rugged stone.

But stones concreted in the kidneys, are sometimes so numerous, that they choak up and corrupt the substance of the kidneys, by their pressure. Sometimes a single stone, but of a large size, effects the same. In the body of a woman about forty years of age, dissected in the presence of a number of eminent physicians and able surgeons, Ruyfch (a) found a large stone in the left kidney, lodged partly in the substance of the kidney, and partly in its pelvis, which in size and shape very nearly resembled a root of ginger; he has portrayed this stone in three figures, namely bifarious as it appeared in the kidney upon dissection, then the part that occupied the pelvis, and the last figure represents the stone extracted from the kidney and pelvis, that its whole fabrick might appear to view. He also (b) found a pretty large stone in the pelvis of the left kidney of a boy about three years of age, who before his

(z) Elements of Physiology. vol. ii. p. 247. 248. (a) Observat. Anatom. Chirurg. Obs. 56. p. 52. (b) Ibid. p. 53.

death had voided above fifty stones, many of which were about the size of large peas. Many such cases are to be found in medical authors; these are sufficient to demonstrate all the bad consequences, that may be apprehended from a stone's lodging in the kidneys.

Stones in the kidneys, sometimes not only destroy their substance, but also irritate and inflame the parts adjacent to the kidneys, by compression, or their rugged shape, (especially if the substance of the kidney be already destroyed in any particular part) and from the consequent suppuration, purulent matter sometimes makes its way outwardly, and often these disorders degenerate into fistulous ulcers of the loins, through which sometimes stones of various sizes are evacuated. See what has been said concerning the suppuration of the kidneys, at § 1001.

A remarkable case of this kind is to be seen in Tulpius (c), of a counsellor, who, descended from a calculous father, had from his childhood been subject to nephritic complaints. In this gentleman the stone made its exit through an abscess in the loins, but a callous ulcer remained in the part, through which the urine constantly dripped mixed with purulent matter. Various remedies were tried, and among others the Spa waters, and the warm baths of Aix la Chapelle were used without the least benefit. *Quin potius, occluso per lumbos exitu, et derivato deorsum sordissimo pure, incidit tandem in febrim acutissimam, quae ipsum in miserandum modum occidit.* “ But rather, the discharge of purulent matter through the ulcer in the loins being stopped, the foetid pus was thrown upon the constitution, and the patient being seized with a violent fever, died miserably.”

(c) Observ. Medic. lib. iv. cap. 28. p. 320.

Whence likewise it appears, that it is dangerous to heal such an ulcer, unless it is first apparent, that the urine and pus freely pass into the bladder, and are voided through the uninary passage; which is known from the ulcer's ceasing to discharge any more purulent matter, and yet no fever, or other bad symptoms ensuing.

S E C T. MCCCCXVII.

WHEN the same, from what cause soever, is moved from the place of its formation (1415) into the pelvis, and from thence into the ureter, its windings, the narrowest parts of its diameter, or its opening into the bladder, it often causes a suppression of urine, with inflammatory excruciating pain.

It has already been mentioned, that round the protuberant surface of the renal papillæ, a loose membrane is extended in such a manner, distinct from the papillæ itself, as to form a larger space like a funnel, for receiving the papillæ into its cavity, and the urine dripping from the secretory vessels, which are called the Bellinian tubes, and whose open extremities form these papillæ, which singly, or several together are received into these membranous funnels. The other extremity of these membranous tubes, or funnels, conducts the urine dripping from the papillæ, into a certain common cavity, called the *pelvis*, which is also membranous like them, and formed by two or three of these tubes meeting together in one, and with others of the same kind, at last forming by that union, three hollow trunks, which again unite and open, but without the concave part of the

the kidney, into one conical canal, called the *pelvis*, which afterwards produces a long pipe, that is called the *ureter*, and conveys the urine to the bladder.

Whence those three hollow trunks, and the large canal in which they unite, form what is called in man the *pelvis*, of which the ureter is a continuation. The lower part of the *pelvis* protrudes beyond the cavity of the kidney, while the superior part is as it were hid in the substance of the kidney. Moreover, such is the situation of the *pelvis* in man, that it receives the strong pulsations of the emulgent artery, whereby the nephritic gravel, that is beginning to lodge in the *pelvis*, is removed, and as it were washed away by the urine, and drove into the ureter. This seems to be the reason, that calculous concretions less frequently happen in the *pelvis* of the kidneys, than they otherwise would, if it were not for this aid.

The consideration of this fabric, induced the celebrated Winslow, (*d*) for the easier understanding thereof, to describe the ureter as if taking its rise in the lower part, and ascending, it opened into the inferior part of the renal sinus, being now become wider near the kidney, and before it reaches the sinus of the kidney, divided into branches, which subdivided in the substance of the kidney, farther form those membranous tubes or funnels, that receive the papillæ of the kidneys. Eustachius's tables, if compared with the description, will serve to illustrate it further.

The ureter, a continuation of the *pelvis*, thus descends obliquely, very little inflected, from both kidneys, as far as the lateral anterior superficies of the *os sacrum*, it there passes between the gut rec-

(*d*) Exposit. Anatomique, § 421, p. 552.

tum and the urinary bladder, into which it is inserted laterally at about the distance of two fingers breadth from the neck of the bladder; but before the orifice of the ureter opens into the cavity of the bladder, it runs obliquely some distance between the coats of the bladder, and then thro' an oval aperture, which is narrower than the diameter of the ureter, empties the urine into the bladder; nearly in the same manner as the *ductus choledochus communis* passes between the coats of the gut *duodenum*, before it opens into its cavity. The edge of the orifice of the ureter, where it penetrates into the bladder, is thin, and seems to consist of the internal coats of the ureter and bladder conjoined (*e*).

The ureters are round canals, of equal thickness through their whole descent in a sound state; they are usually found enlarged in those, who have frequently voided renal stones; after retentions of urine of long continuance, or from stones lodged therein a length of time, they have sometimes been found dilated to a prodigious degree, as will be presently shewn. Indeed they are elastic, and may be dilated both in their width and length, yet soon restore themselves to their usual state, unless by long continued dilatation, they have almost entirely lost their elasticity. The internal surface of these canals is ligamentous, and bedewed with a mucilaginous humour; moreover it has longitudinal wrinkles and folds, and many such, but smaller, placed in a transverse direction, that intersect the others.

If therefore gravel, called nephritic, formed in the substance of the kidneys, or lodging about the renal papillæ, or already compacted into larger lumps, is moved from its place, through its own

weight, violent exercise, riding on horseback, or in a carriage, or from any other cause, it may first lodge in the pelvis, because the ureter is much narrower than the pelvis, and there most frequently renal stones are retained, and increase in bulk, and thus by compression injure and destroy the substance of the kidneys, as has been said in the preceeding paragraph.

A great quantity of fat loading the kidneys may in a very especial manner conduce to the detention of the stone in the pelvis. We learn from anatomy, that the renal sinus or cavity, where the renal vessels enter and go forth, and where the inferior part of the pelvis projects, are covered and every where wrapped up in a quantity of fat. Eustachius, *banc pinguedinem (f) adeo concretam et duram aliquando invenit, ut lapidis duritiem fere aequaret; qua pinguedine renes obstrui, et constringi ac plurimum imminui, non semel vidit.* “ Sometimes
“ found this fat so hard, as almost to resemble
“ stone; by which fat he had more than once seen
“ the kidney obstructed, compressed, and also ve-
“ ry much wasted.”

From these and other similar causes the passage of the stone from the pelvis into the ureter may be impeded; and the greater bulk the stone attains by its stay in this place, the more difficult will its expulsion prove, and at length it will be rendered wholly impassible. Tulpius (g) observed in the body of a man, *in utroque rene calculum, dispergentem se quadruplici ramo, crucis instar, per universam renis substantiam, adeo ut non potuisset inde eximi, nisi decerpiscisses frustulatim totum ipsius parenchyma.*
“ In either kidney a stone that spread itself into
“ four branches, like a cross, through the whole

(f) Opuscul. Anatom. de renum structura, cap. 45. p. 120.

(g) Observ. Medic. lib. ii. cap. 44. p. 165.

“ substance of the kidney, so that it could not
“ be extracted from thence without tearing to
“ pieces its whole fleshy substance.” He urges
this observation against those, who advise nephro-
tomy, where the stone in the kidneys had acquir-
ed such a bulk, that there remained no hopes of
its passing into the ureter; a circumstance that
will be considered by and by. But where stones
pass from the pelvis into the ureter which is much
narrower, they there first meet with an obstacle to
their further progress, unless they are so very small,
as easily to slip through the cavity of the ureter
into the bladder. In this part stones frequently
lodge, which by degrees increasing in size, entire-
ly stop up the mouth of the ureter, so that not a
drop of urine can pass from the kidney to the
bladder; if this accident happens in both kidneys,
a fatal suppression of urine is the consequence.
Tulpius saw such a case (*b*) in the body of a wi-
dow, about forty years of age, who after long
continued excruciating nephritic pains, attended
with reachings to vomit, a fever, strangury, and
difficulty in making water, at last laboured under
a total suppression of urine; so that not having
voided a single drop for eighteen days, she became
comatose, and died convulsive. The left kidney
was found swelled, and livid on the external sur-
face; being cut open, the inside appeared distend-
ed with stones, and a quantity of urine, the largest
of which being of a conical form, its small end
had insinuated itself so far into the beginning of
the ureter, as entirely to close it up: the wider ba-
sis of the stone preventing its further passage. In
the right kidney was found a broader stone, which
like a lid covered the origin of the ureter, and
thus equally prevented the passage of the urine to
the bladder.

(*b*) Ibid. cap. 45. p. 167.

In the ischury, prudent physicians use their utmost endeavours to discover, whether the obstacle that impedes the passage of the urine, be situated in the kidneys, ureters, or about the neck of the bladder. If the latter is the cause of the disorder, the bottom of the bladder distended with urine, may be felt above the *os pubis*, and the urine be discharged by introducing a catheter, or by puncturing the perinaeum: Moreover the patient feels a great tension and pain about the pubes, and in the perinaeum. But if the bladder is empty, and the patient labours under an ischury, it may with certainty be concluded, that the cause of the disorder lies higher, namely in the kidneys or ureters.

After a stone has passed from the kidney into the ureter, it has still a long journey to make, before it arrives at the bladder. For although the ureters are lubricated internally with a slippery mucus, are round, capable of extension, compress the adhering stone from their elasticity, and thus promote its descent, yet it is very often observed, that stones lodge a great while in this passage, and increase in bulk. It is indeed true, that the ureters are delineated, by Vesalius, and Eustachius, in their plates, hardly at all inflected, and of the same width throughout their whole length; but Nuck, (i) where investigating the course of the lymphatics through the viscera, affirms: *Circa ureteres, quos authores a renibus ad vesicam æqualiter (sed male) extensos delineant, hoc observavi, et perpetuæ veritatis esse jam toties notavi, illos nunquam, tam in sexu masculino, quam femineo, esse æquales ubivis, sed tribus, quatuorve, et aliquando quinque, in locis angustatos conspici, speciatim vero circa illorum exitum in vesicam.* “ I have

(i) Adenograph. curios. cap. vii. pag. 76.

“ made

“ made this observation concerning the ureters,
“ which authors delineate (but wrongly) of equal
“ width from the kidneys to the bladder, and
“ have been repeatedly convinced of the truth
“ of it by ocular demonstration, that they never,
“ either in the male or female sex, are of equal
“ diameter in every part, but appear contracted
“ in three or four, and sometimes in five dif-
“ ferent places, particularly about their opening
“ in the bladder.” He gives the figures of some
such coarctations of the ureters in his treatise.

It has been already observed, that the internal surface of the ureters is rugous; whence also the stone may be hindered in its descent, especially if it is angular or rugged.

But besides these, there is also another cause, why the shape of the ureter is so often found præternaturally changed, at least in those who are subject to breed stones in their kidneys. When a stone slips into the ureter, and begins to stick there, a pain is felt, more or less intense, according as the stone happens to be more or less angular or rugged: Whence it appears that the internal surface of the ureters is extremely sensible, and violently irritated from the passage of the stone, especially, when a stone for the first time descends through the cavity of the ureter: hence *ceteris paribus* the first nephritic fit is commonly the most severe. I have known patients who have frequently voided stones before, foretell to the physician and bystanders, that a stone then passing through the ureter, would prove rugged and angular, because they felt more acute pain than usual. The grieved ureter therefore contracts and straitens its cavity, and thus impedes the descent of the stone. Hence such troublesome symptoms accompany a nephritic fit, if it is very violent; perpetual watchings, fever, vomitings,

vomitings, etc. If a drop of vinegar falls upon the eye, it irritates the very sensible internal surface of the eye-lids, or if a rough grain of sand sticks between the eye-lids and the globe of the eye, the eye-lids are so forcibly closed, that they can hardly be forced open. In the chapter concerning *Eruētations and wind*, we observed how forcibly the intestines are contracted when violently irritated by any acrid substance. The symptoms excited by the passing of a rough stone through the ureter, are so like the griping pains of the bowels proceeding from a strong inflammation, or the irritation of an acrid substance, that physicians have named the distemper which arises from the passage of a stone, the nephritic cholic. Besides, in the chapter on the *inflammation of the bowels*, it was inculcated, that this disease, in the beginning especially, cannot always be easily distinguished from a nephritis: Mean while, it was likewise remarked, that from such a mistake in the diagnosis the patient ran no risque, as both diseases require a similar treatment, as will hereafter appear, when we treat of the cure of the stone in the kidneys.

Helmont has very justly remarked this, (k) and hence condemns diuretic medicines, especially if they are powerful ones. *Veruntamen, quia, transeunte calculo, ureter prae dolore contractus plerumque crispatur, diuretica in paroxysmo danda cum praecautione. Nimirum propinanda sunt doloris, et crispaturae inde natae, inhibitiva. Cujus solius puncti incuria, vel inscitia, subinde contigit, calculos media stetisse via, et miserandis ejulatibus recuisse, etc. Neque enim putandum, canalem ureteris esse inaequalis stricturae, ut calculus, qui per ureterem primo impulsu descendit, tandem, angustia iti-*

(k) De Lithiasi, cap. v. § 16. pag. 686.

neris pressus, haereat; sed compressiones posteræ sunt crispaturæ morbosæ, ac spasmodes a dolore. “Ne-
 “vertheless, because, while the stone is passing,
 “the ureter contracted through pain has gene-
 “rally strictures, diuretics are to be administered
 “with caution during the fit. Doubtless le-
 “nients and relaxants are to be taken, to as-
 “swage the pain and, relax the stricture occa-
 “sioned thereby. From negligence, or igno-
 “rance of which single point, it frequently has
 “happened that stones have stopped in the passage,
 “and occasioned death after horrid tortures, etc.
 “For it is not to be supposed, that the canal of
 “the ureter is of unequal diameter, and that the
 “stone, which from the first impulse passed
 “down into the ureter, at length compressed in
 “a narrow part of the canal, lodges there; but
 “the latter coarctations are morbid and spasmodic
 “strictures from pain.” He confirms the same
 in another place (1): *Nephriticus ergo dolor im-*
manis ille a contractura: non autem a boli vel sabuli
transitu. Saepe enim magnus calculus postmodum
minus dolet, qui minutulus primum summe dolorificus.
 “This cruel nephritic pain therefore proceeds
 “from a stricture: and not from the passage
 “of a solid body, or gravel. For frequently a
 “large stone will give less pain in the sequel,
 “which at first when small occasioned excruciat-
 “ing tortures.”

In the history of the Nephritis at § 994. it has been proved that a long continued spasmodic stricture of the vessels, is justly to be considered as one of the causes of the nephritis. It has been there remarked, that persons have been sometimes seized with an ischury, the first time a stone has passed from their kidney to the bladder,

(1) Ibid. cap. vi. § 15. pag. 690.

though the stone voided by the urinary passage within a few days after; was rugged indeed, but so very small that it did not seem in the least probable, that it could have plugged up the cavity of the ureter; nor was there the smallest room to suspect that the other kidney had ever been affected with a like disorder. This is strongly confirmed by the extraordinary case of a childbed woman, who died of an ischury, on the eleventh day after delivery, the bladder continuing empty. After death, nothing præternatural was discovered in the viscera, except an inflammation in both kidneys, but without tumour. In the left kidney was found a rugged stone, about the size of a pea, which certainly could not have produced the suppression of urine by stopping the passages, but rather must have closed them by a spasmodic stricture.

But the greatest obstruction that the stone meets with in its passage through the ureters, is about the opening of the ureters into the bladder; for there the ureters run for some distance between the coats of the urinary bladder, and their extremities become much narrower. Galen has excellently remarked this circumstance (*m*), and compared it to the insertion of the *ductus choledochus*. For he says, that the ureters open into the bladder like a membrane, which by the descending urine, *evertitur ac patefit, reliquo vero tempore omni concidit, ac contrahitur; atque ita meatui firmum efficitur operculum, ut non solum humoribus, sed et flatibus, reclusus omnis sit interclusus*. “Is dilated and
“opens, but at all other times fall down flat and
“is contracted; and thus a firm cover is formed
“to the mouth of the ureter, that not only all

(*m*) De usu partium, Lib. v. Cap. 13. Chart. Tom. iv. pag. 410.

“passage is denied to fluids, but also to air.” Hence it seems as if Galen suspected a valvular fabric in this part. Indeed he was confirmed in this opinion, by observing that a blown up bladder does not discharge the air through the severed ureters. At least it hence is evident, that the part of the ureters which passes through the coats of the bladder, is compressed in such a manner by the distending fluid, that the urine cannot regurgitate in the ureters from the cavity of the bladder: and anatomists in general agree, that the apertures of the ureters in the cavity of the bladder, are narrower than the cavity of the ureter in its whole course; whence they have justly drawn this conclusion, that a stone passing from the kidneys finds a difficulty in getting through this place, and therefore must remain there some time. From dissections we learn, that stones have frequently been found here, which from their long stay have sometimes grown to a prodigious size, as has been observed at § 1414. Sometimes such stones protrude one of their extremities into the cavity of the bladder, while the other part is covered by the coats of the bladder and the dilated ureter, of which circumstance we shall speak more fully in the sequel, in the section where we treat of Lithotomy. Besides, which seems very likely, the ureters in this particular part as well as in the rest of their course, may be irritated by a rugged stone, and hence form a stricture, that may encrease the difficulty of passing.

When a stone lodges in this part, if it wholly stops the passage of the urine constantly dripping from the kidneys, the ureters by degrees will be filled, as well as the pelvis. But as it is demonstrated in Hydrostatics, that the bottom, sides of the vessel, and cover, are compressed by the particles

particles of the fluid immediately touching them, that this pressure increases in proportion to the height of the fluid, (*n*) and depends on the height, not on the quantity of fluid, it is clear, in this situation, the stone must be liable to a vast pressure, and at length frequently be forced from this strait passage into the cavity of the bladder, not without preceeding exquisite tortures, as the pressure of the incumbent fluid becomes the greater, the lower the stone is lodged in the ureter. Moreover, as the sides of the vessel containing the fluid suffer the same pressure as the bottom, the reason is plain, why the flexile sides of the ureters are so greatly distended in such cases; nay and also the kidneys, which must be considered as the covers of the vessels, are so exceedingly dilated.

In the body of a surgeon, who had been long afflicted with nephritic complaints, Ruysch found a stone in the left ureter, (*o*), the size and shape of an olive, that entirely prevented the passage of the urine. *Pars hujus ureteris supra calculum, propter calculorum transitum, admodum erat dilatata, infra eundem vero naturalis capacitatis, ast rubicundior justo, ab inflammatione excitata. Renem ejusdem lateris monstrosae magnitudinis, ut et ureteris maximam partem, aqueo humore obsessum invenit; cujus liquoris motum saepissime percepit aeger, cum se moveret.* “ The part of this ureter above the
 “ stone, from the passage of former stones was
 “ very much dilated, but below the same, it was
 “ of its natural width, though redder than usual,
 “ from inflammation. He found the kidney of
 “ the same side, of a monstrous bigness, and as
 “ well as the greatest part of the ureter, sur-

(*n*) Gravesande Element. Physic. Math. Lit. 111. cap. 3. pag. 406. (*o*) Observat. Anatom. Chirurg. No. xv. pag. 16.

“ rounded

“ rounded with an aqueous fluid, the motion of
“ which fluid the patient upon moving his
“ posture very frequently perceived.” The great
Ruyfch indeed ascribes this distension of the ure-
ter to the frequent passage of stones; but had this
been the real cause, the whole length of the ureter
must have been dilated, as is evident from what
has been just said. He found in a sheep, the
ureters so dilated that they would admit a large
carrot; moreover he saw the kidneys so distended
and filled with an aqueous fluid, that each of
them contained almost two full pints. He dis-
covered in each kidney a membranous obstacle,
through which the urine could easily be pressed
from the bladder up to the kidneys, but he
could not press any thing from the kidneys and
ureters towards the bladder through a small ori-
fice in the membrane, without using force (*p*).

Whence the reason is evident, why so great
a dilatation of the ureters, such a surprizing dege-
neration of the kidneys, is sometimes found in
the bodies of those who have died of a suppres-
sion of urine. Thus in such a case (*q*), both
ureters were found incurvated in various flexures,
and so enlarged, that the diameter of the left
exceeded four inches, and that of the right ureter
an inch and an half. The substance of both kid-
neys was wholly destroyed, and extended into a
thin membranous bag; the left of which equalled
in size the head of a child four years old, the
right was as large as a man's doubled fist: these
dilated parts were filled with a yellowish, inodo-
rous serum. This wonderful distension of the
kidneys and ureters was produced from obstacles
situated in the inferior part of the ureters. For

(*p*) Ibid. Observ. 99. pag. 92. (*q*) Anton. Storck Biennium
Medic. pag. 256.

near the insertion of the left ureter into the bladder a callous hardness like a filbert was discovered, which entirely prevented the least drop of urine from passing into the bladder. Moreover the right ureter at the distance of an inch from the bladder was very firmly constricted, inflamed, and in a state of mortification. In this case the ureters had not been distended through the passage of stones, but from the pressure of the distending urine, which acts more powerfully, in proportion as the obstacle hindering the descent of the urine into the bladder, is situated nearer to the bladder. Whence likewise we learn the reason, why this poor man complained of pains from his groin up to the kidneys in both sides, and a rack-ing tension in his loins.

That the ureters are sometimes inflamed, and therefore all the consequences of inflammation are to be apprehended, from such a dilatation of the ureters, and also from the injury they receive from the passage of rugged stones, is easily comprehended: for they consist of vascular coats, the pain is sometimes exquisite, when a rugged or angular stone is fixed therein, and these torturing pains are accompanied with vomitings and convulsions in the abdomen. From what has been before said concerning the causes of inflammation, it is sufficiently clear, that these are sufficient to produce an inflammation, and all its consequences. An inflammation, and incipient gangrene had seized the right ureter in the above cited case; in the left ureter was found a callous tumour. But suppurations of the ureters also are observed.

When the kidneys suppurate, there can be no doubt, but purulent matter may make its way from them into the cavity of the ureter, which, if the passage through the ureter to the bladder

happens to be obstructed, may be prodigiously distended with pus. Ruysch has described such a case, (*r*) and has given a copper plate of a monstrous ureter, dilated to such a degree, that it contained at least a pint of purulent matter, in the inferior part of which a stone was lodged, the size of a filbert, which at last closed up the passage; for the patient had before voided purulent urine. This poor woman underwent extreme tortures, till wished for death put an end to her misery. The celebrated de Haen, (*s*) in the body of a man, whose bladder altogether ulcerated, contained a stone that weighed almost four ounces, saw the left kidney enlarged, and full of purulent matter, and the ureter exceeded in size the gut *colon*. In either of these cases, the matter might make its way from the kidneys into the ureters, and there confined, distend them prodigiously. But another case is related, (*t*) where in the body of a man an abscess was found extending the whole length of the right ureter, from its insertion into the bladder, quite up to the kidney.

S E C T. MCCCCXVIII.

WHEN it has passed into the bladder through the uterers, it is frequently expelled.

To wit, if the renal stone is of so small a size that it can pass through the cavity of the ureter. But although the size of the stone may exceed the natural cavity of the ureter, yet there are still

(*r*) Observat. Anat. Chirurg. No. 94. pag. 87. (*s*) Ratio Medendi, Tom. v. pag. 147. (*t*) Academie Royale de Chirurgie, Tom. 1. pag. 401.

hopes left, that it may descend into the bladder : for the ureters are dilatable, and when the stone begins to lodge in this passage, from their elastic power they contract, and move the stone forwards, in which, the slippery internal surface of the ureters, that is naturally bedewed with a mucous fluid, greatly assists. Likewise at the time the stone is protruded from the pelvis through the ureter, frequent and violent vomitings come on, and from the strainings to vomit the descent of the stone is promoted. But if it is lodged in such a manner, that it entirely stops up the cavity, the urine constantly distilling from the kidney, will fill that part of the ureter, which is above the place where the stone sticks ; therefore the whole column of the incumbent fluid presses on the stone, and propells it downward. It has already been demonstrated that this force is very great, and increases in proportion to the height of the incumbent column. Stones would certainly oftener stick at the very entrance of the ureters into the bladder, where the canal is narrowest, did not the then higher column of urine retained in the ureter, press on the stone with greater force. But where the size and shape of the stone is such, that it indeed passes with difficulty, but yet does not entirely prevent the passage of the urine, then such stones frequently lodge in some part of the ureter, and by degrees increase in size so much, that their expulsion may be rendered altogether impossible. Such cases have occurred frequently enough, as has been before observed ; nay, and sometimes in such stones a little hole has been seen hollowed out by the constant dripping of the urine, through which it passed into the bladder, though the size of the stone was perpetually increasing from its stay.

But it is a well known fact, that renal stones, are often happily voided by the urinary passage. *Anus septuagenaria, defatigata aliquamdiu, a febre, ac dolore lumborum, minxit tandem, unico impetu, quasi relaxatis repagulis, trecentos amplius calculos.*

“ A woman seventy years of age, long afflicted
 “ with a fever, and pains in her loins, at length
 “ voided by urine at one effort, the impediment
 “ being as it were removed, above three hundred
 “ stones.” (u) He saw a like number of stones voided by another woman, who passed the remainder of her life free from nephritic complaints.

S E C T. MCCCCXIX.

IF it remains in the bladder, it grows by the apposition of circles, like an onion.

It has been proved by a variety of circumstances, at § 1414. that the elements of the stone, contained in the urine of even the healthiest persons, grow to any indissoluble body that they may find in the bladder. It sometimes happens, after an inflammation of the bladder, acrid diuretic medicines, and from other perhaps less known causes, that the internal coat of the bladder comes off, which separated from all cohesion, swims in the urine in the cavity of the bladder, and not being a dissolvable substance, the calculous matter adheres thereto. I have seen after a suppuration of the bladder, its internal coat voided with the urine, which when unrolled, appeared large enough to cover the whole bladder. However not the

(u) Tulp. Observ. Medic. Lib. 11. cap. 47. pag. 171.

least trace of accreted calculous matter appeared on this membrane; for it did not seem to have remained long in the bladder of the poor woman, before it was excreted. Tulpius (*w*) saw a woman, who was thought to be afflicted with the stone, *eminxisse tandem membranam sat amplam, obductam exilibus lapillis, sed in medio ita perforatam, ut per biatum illum commode excerneretur urina.*

“ At last void by urine a pretty large membrane, encrusted over with little stones, but so perforated in the middle, that the urine might conveniently be excreted through its orifice.” Some fragments of the membrane, however, still remained in the bladder, which created so much trouble before they were voided, that an incontinence of urine was the consequence, which notwithstanding was afterwards cured by corroborative remedies. It is to be remarked, that a much larger membrane might be voided in women; for in the female sex the urethra is shorter and wider, nor is it incurvated: in men, it can scarcely pass except in the form of pellicles.

It has been remarked at § 1414, that the calculous matter indeed adheres to any indissoluble substance, but most readily to a stone already formed in any part of the body. When therefore a renal stone, having slipped through the ureter, arrives in the bladder, unless it is soon expelled thence, it will afford a basis for a stone in the bladder, which frequently grows to a prodigious size, as is evident from the preceeding observations.

The stone increases faster in the bladder, than when it was lodged in the kidneys, because the bladder collects a far greater quantity of urine; and often retains it, when collected, several hours;

while the secreted urine only glides over the stone lodging in the kidney, nor can stagnate in any quantity about the stone, unless the free passage of the urine from the kidney through the ureter be obstructed. Besides, the urine collected in the bladder, by the heat of the place, its stay, and perhaps the resorption of its thinner aqueous parts, is rendered higher coloured, more acrimonious, and more foetid, than when it was first secreted from the blood in the kidneys. Indeed, the kidneys of sound animals are reckoned dainties, nor have they an urinous taste. Whence the aqueous part being dissipated from the urine contained in the bladder, the quantity of calculous matter is the greater, and as at the same time, the urine has a greater tendency to putrefaction, it may more readily separate from the urine, and perhaps in larger quantity; this was the opinion of the famous Hales (x) who has made so many curious experiments on the human calculus. Nay he imagined, that the stone grew fastest in the summer; because the urine is then higher coloured and more acrimonious, from the dissipation of a greater quantity of its aqueous parts through the increased perspiration at this season, and frequent sweats. Hippocrates seems also to indicate something of this kind (y). For after he has said, in those who freely void their urine, nothing is collected in the bladder; he adds, *Quum enim magis, quam pro natura, fuerit calefacta (vesica), inflammatur os ipsius. Quum vero haec patitur, urinam non demittit, sed in seipsa concoquit, et adurit, et quod quidem in ea tenuissimum secernitur, quodque purissimum, transit, et emingitur; quod vero crassissimum est et turbidissimum, colligitur et condensatur, et primo quidem parvum, dein majus fit. Circumvolutum enim ab urina,*

(x) Hæmastatics on the animal calculus, p. 217, 225.

(y) De aere, locis, et aquis, tom. vi. chart. p. 200.

quicquid crassum collectum fuerit, ad seipsum adaptat, et applicat, sicque augetur, et in totum durescit, etc. Signum autem, quod hoc ita se habeat, hoc est, quod, qui calculo laborant, urinam limpidissimam reddant instar feri; quia id, quod crassissimum est, et turbidissimum, isthic manet, et coalescit. Et sane plerumque hoc modo lapidem contrahunt. “ For when the
 “ bladder is præternaturally heated, its neck be-
 “ comes inflamed. And when it is afflicted in
 “ this manner, the urine does not pass, but is as
 “ it were boiled and burnt there; upon which the
 “ thinnest and clearest part is separated and car-
 “ ried off, while the thickest and most turbid, is
 “ collected and condensed, at first in a small
 “ quantity, afterwards in a larger. For being
 “ rolled there by the urine, whatever is of a
 “ thick consistence it adapts to itself, and thus in-
 “ creases and becomes callous, &c. That the
 “ case is thus, is plain: for the water made in the
 “ stone is very clear like whey; because the thick-
 “ est and most turbid part remains behind, and is
 “ collected together; and in this manner the stone
 “ is generated for the most part.”

It is observed in persons, who are afflicted with the stone, particularly if the stone is large, and the disease of long standing, that the urine discharged from the bladder is of a much paler colour than healthy urine, and has a very foetid smell. For when the external surface of the stone, from the application of fresh calculous matter, is soft, and from the interstices left here and there, resembles a pumice stone, it imbibes the urine, and retains it a considerable time; which putrifying, exhales a foetid smell, till from the rolling of the stone in the bladder, and the compression of the bladder, the surface is rendered more hard and smooth; for the same reason, putridity being once produced, all the urine, that is brought to the

bladder from the kidneys soon becomes putrid, and adds fresh calculous matter to the stone: for the greater part of the substances that tinge the urine seems to adhere to the stone; whence a pale coloured urine is voided, which emits a foetid odour, that sometimes is not a little offensive both to the patient and the by-standers.

Hence we see the reason, why the stone encreases in size by the apposition of circles, of which circumstance we have already treated at § 1414, and shall speak further in the next paragraph.

S E C T. MCCCCXX.

THE nucleus, or original kernel in the centre, always continuing red, the other circles being red, white, ash coloured, or bluish, and from these several colours, the degree of insolubility and solidity is known, as we learn from chemical experiments.

Renal stones passing into the bladder afford more frequently than any thing else, a nucleus and basis to stones of the bladder; in these very renal stones, when they have been soon voided, before they had increased in size in the bladder through the apposition of circles, I have sometimes discovered the nucleus, to which the other substance of the stone had adhered by thin plates. And as the gravel itself is most usually of a reddish colour, hence renal stones, also frequently are of that colour; but not always; whence it does not seem an absolute fact, that the nucleus of a stone in the bladder is always red.

Besides the bladder itself is subject to inflammation, suppurations, hæmorrhages, &c. by which diseases

diseases indissoluble bodies may be produced in the cavity of the bladder; which may become the basis of a stone, to which afterwards fresh calculous matter will adhere in circles. The stone in the bladder is usually, and indeed not unaptly, compared to the root of an onion, in the centre of which the germ of the future plant is situated, wrapped up in a great many sphaerical coats, mutually laid over each other, which can be peeled off one after another till the germ is left quite bare: the same also holds good in other bulbous roots. But in the stone of the bladder, these circles that surround the nucleus are sometimes observed of various colours, and different thicknesses.

It has been before observed at § 1414, that the elementary principles of the stone, when separated from the urine, are not always of the same colour. Upon which account Eustachius (z) finds fault with those who asserted, that renal stones might be distinguished from those bred in the bladder by their colour alone: *Quandoquidem renum lapides rubei, vel crocei, non perpetuo occurrunt, sed non raro albi, et cineritii, conspiciuntur.* “Be-
 “ cause renal stones are not always found of a red
 “ or deep yellow colour; but are frequently seen
 “ white, and of an ash colour.” For he himself saw, in *Episcopo Senogaliensi lapidem album insignis magnitudinis principium vasis urinarii occupare, reliquum vero cavitatis renum innumeris fere lapillis ejusdem coloris repletum esse.* “In the bishop of Sin-
 “ gaglia, a white stone of remarkable size, seated
 “ in the beginning of the ureter, and moreover
 “ the cavity of the kidneys, almost filled with lit-
 “ tle stones of the same colour.” I have myself seen stones of different colours voided by the same man, nay, and have observed in the urine of the

(z) Opuscula Anatomic. de renibus, cap. 45. p. 122.

same person, the elementary principles of the stone differ from each other in colour.

It seems very likely, that the urine does not always contain the same plenty of calculous elements, nor do they always separate from the urine with equal facility: hence it may happen, that sometimes urine for some time may add little calculous matter to the stone contained in the bladder, as has been said in the preceeding paragraph. Then the stone, by its rotation in the cavity of the bladder, and the forcible compression of the bladder while it expels the urine, acquires a smooth surface; which remains so, till the urine at another time, loaded with abundance of calculous matter, applies fresh elementary calculous principles to the polished surface of the stone, which is then rendered rough, and continues so, till it is again worn smooth from the like causes as the former. Thus it is sufficiently evident, that the stone of the bladder increases by the apposition of circles. Hereafter at § 1428, where we shall treat of lithontriptics, it will appear, that eminent physicians have entertained great hopes, that by means, of medicine the urine might be changed in such a manner, as either to furnish none, or at least less calculous matter; nay some have flattered themselves, that it might sometimes happen, that the urine being rendered medicated, by gently corroding the surface of the stone, might so lessen the cohesion of the constituent parts thereof, that they might be easily rubbed off, and thus the size of the stone be diminished by degrees.

Hence also we understand, why calculous persons are sometimes better, and sometimes worse. When the surface of the stone is smooth, the bladder is less injured; but when a fresh heap of calculous matter is applied to the stone, forming a new coat, the symptoms will be encreased. More-
over

over, this rugged surface of the stone imbibes and retains the urine in the bladder, which growing putrescent, corrupts the urine flowing from the kidneys into the bladder, and renders it more acrimonious, and thus all the symptoms will be increased.

A man, about fifty years of age, who had been afflicted with a stone in his bladder eighteen months, used to be three weeks together in the most excruciating torture, and the three succeeding weeks entirely free from pain; and at the expiration of that period, his former tortures constantly returned, not only on the same day, but at the very same hour (*a*). Besides three or four days previous to the returning of his pains, his perspiration became extremely offensive, he felt great anxiety, and his left leg swelled; the swelling however went down while he kept in bed.

Whitish stones are almost always more brittle than others; the ash coloured are harder, and stones of a blackish ferrugineous cast are generally supposed to be the hardest of all.

The chemical analysis of calculi has been fully treated of at § 1414.

S E C T. MCCCCXXI.

WHEN it stops in the bladder it causes inflammation, and its consequent symptoms, and also compression, and frettings of the part, ulcerations, purulent urine, stranguries, an obstruction of the urethra, and an impossibility of making water except in a supine posture of the body, an hectic fever, and consumption;

(*a*) Beverwyck Steenstuck Eerste deel, c. 8. p. 113.

and is frequently immoveably fixed in the passage of the urethra.

As at § 1416, we treated of the bad consequences that were to be apprehended from the stones lodging in the kidneys; so we shall now consider those that usually accompany or happen from the stone's remaining in the bladder.

When a stone has slipped from the kidneys into the cavity of the bladder, the patient finds great relief: if the nephritic pains have been very violent, he usually complains for a day or two after, of a dull pain in the affected kidney, and through the whole course of the ureter. But when such stones are not so large; they cause hardly any uneasiness when they have once slipped into the cavity of the bladder. Mean while patients ought not to trust to this abatement of their pains, as such a stone, unless soon evacuated, growing larger, their pains will return with greater violence. If the stone is of an angular or pointed shape, the bladder will be injured, when after a plentiful discharge of urine, it is contracted to such a degree, as to leave no cavity; for then the extreme sensible internal surface of the bladder will be fretted by the rugged stone. The bladder receives numerous branches from the crural nerves, and the inferior mesenteric plexus. Stranguries from acrimonious urine, and the shocking yells of calculous patients sufficiently prove the exquisite sensibility of the bladder. Aretæus (*b*) after having said that the bladder undergoes great pain when it suffers by consent of parts, but far more violent and fatal pains when disordered itself; adds as a reason, *quandoquidem omni corpori, et nervis, et menti, labem communicare valentissime*

(*b*) De causis et signis morbor. acut. lib. 11. cap. 10. p. 23.

poteſt.

potest. Quippe vesica nervus frigidus albusque est.

“ Because it is capable of violently disordering
 “ the whole body, both nerves and mind. For
 “ the bladder is a cold and white nervous sub-
 “ stance.” Which he confirms in another pas-
 sage, (c) saying : *Sed in hoc membro acutior dolor est,*
interitusque celerrimus; vesica enim nervus latus est.

“ But in this member the pain is more violent, and
 “ very quickly terminates in death; for the blad-
 “ der is a large nerve.” I am sensible indeed, that
 the name of nerve has been given by the antient
 physicians to some parts of the body, that pro-
 perly speaking, are not considered at present as
 nerves; however it is hence evident, that exquisite
 pains have been observed to ensue in consequence of
 the bladder’s being injured; which are particu-
 larly dangerous if attended with inflammation;
Quandoquidem omni corpori, et nervis, et menti, la-
bem communicare valentissime potest vesica (d). “ Be-
 “ cause the bladder is capable of violently dis-
 “ ordering the whole body, both the nervous
 “ system, and mind.” But that the bladder is
 inflamed from the frequent pressure and rubbing
 of the stone against its internal coat, when in a
 contracted state, after having discharged its urine,
 is pretty plain; especially if the stone should be
 rugged or angular; and as this same cause is fre-
 quently renewed, and the acrid urine perpetually
 washes the inflamed part, there can be very little
 hopes of a resolution, but a suppuration will en-
 sue, and purulent urine. Nor could such an ulcer
 be cured, while the same cause continued. But if
 by the operation of lithotomy the stone be happily
 extracted, and the patient in the flower of his
 age, such an ulcer is often quickly cured: for
 the constant irritating cause being removed, the

(c) De Curat. Morb. Acut. lib. 11. cap. 9. p. 110.
 Ibid. lib. 1. p. 23.

(d)

urine cannot be collected or stagnate in the bladder, as during some days after the operation, it all flows through the wound; and therefore the bladder is at that time never distended: and at the same time from the plentiful use of diluting liquids, the acrimony of the urine is much diminished. From all these conspiring circumstances, there is great hopes of curing an ulcer in the bladder arising from a stone lodged in that part.

It sometimes happens, that the bladder inflamed in calculous subjects, suppurates indeed, but in such a manner, that the pus formed does not flow into the cavity of the bladder, but remains collected in the very substance of the thickened bladder. Ruyfch saw an instance of this kind, (e) in the body of a young man twenty five years of age, from whose bladder, after having performed the operation of lithotomy, the lithotomist could not extract the stone; for it was too large, and entirely filled the whole cavity of the bladder, so that there remained only room for a few drops of urine. The bladder, which was of the thickness of a finger's breadth, could be separated into innumerable coats; between which, a purulent matter, exactly like melted fat, was lodged: but little or none of this purulent matter was found between the stone and the bladder. But that this pus had been collected in the cellular membrane of the bladder, is even clear from this circumstance, that the part being wounded, the purulent matter flowed out, in the same manner as the water issues from oedematous legs, when an incision is made in the skin. The like purulent matter was also found between the coats of the kidneys, and ureters.

But, (see § 406), pus retained long in a close place, becomes acrid, grows putrid, and con-

(e) Observat. Anatom. Chirurg. Obs. p. 82.

sumes the neighbouring parts ; and thus the whole substance of the bladder may be consumed, whence terrible consequences ensue : Tulpius relates such a case (*f*) of a young man, who died of the stone after having suffered most exquisite torments. He had two extraordinary large stones in his bladder, but so immersed in mucus and purulent matter, that they could not be felt by the lithotomist ; for which reason the operation was not attempted. He observed upon dissection, the coats of the bladder wholly consumed, the muscular neck of the bladder only, or rather some part of it remaining still uninjured ; whence also the urine was found diffused throughout the cavity of the abdomen.

Aretæus (*g*) has taught us, that spasms or contractions of the nerves, are to be feared in severe disorders of the bladder. The above unfortunate youth had been obliged to pass a whole year in a sitting posture, and to continually keep his head so erect, that he never attempted to rest it on a pillow, but he was seized with an opisthotonos, attended with exquisite pains. More than once the spine of his back was so violently bent back by the opisthotonos, that *universum corpus videretur, instar alicujus globi, retrorsum conglomerari*. “ His whole body seemed rolled up backwards, like a ball.”

These symptoms especially happen, if the stone of the bladder is angular and rugged ; patients are less afflicted, if the surface of the stone is smooth and even, and the stone of a round form. Whence a very skilful lithotomist (*h*) if he found no ill smell in the urine of calculous patients, judged that a stone, hard indeed, but smooth, was contained in the bladder : on the contrary, if the

(*f*) Observat. Medic. lib. III. c. 2. p. 182. (g) Morb. Acut. lib. 2. cap. 10. p. 23. (h) Denys ever den Steen, p. 36, 37.

urine exhaled a very foetid odour, then he prefaged that the stone was angular, hard, and rugged. Sometimes the urine of fuch calculous patients is fo very foetid, that a few ounces are fufficient to fill a large room with an intolerable ftench.

It is eafily conceived, that the bladder already ulcerated, and its exquisitely fenfible neck, are constantly irritated by fuch an acrid putrid urine, with a frequent but almoft vain inclination to make water, while only a few drops are squeezed out with excruciating pain, fometimes fo exquisite that it forces greater outcries from the poor patient, than even the operation of lithotomy itfelf (*i*). I have feen an old man, fixty three years of age, faint while he was uſing his utmoſt efforts to diſcharge his urine; for a mortal ſyncope enfued; and his face diſtorted at the time he was making theſe efforts, preſently aſſumed its natural form, fo that it reſembled that of a perſon in a placid ſlumber. He had for ſeveral years been afflicted with the ſtone, and always made water with great difficulty, with which he voided a great quantity of mucus: but his urine was of a yellowiſh caſt, not always foetid, nor did he ſuffer after making water, when the contracted bladder is preſſed by the reſiſting ſtone, very racking pains: whence I ventured to pronounce, that the ſtone though large was ſmooth. He would not permit the ſurgeon to ſearch him with the ſound, aſſerting, that this had been attempted in vain ſome years before, by an able lithotomiſt in Italy, who introducing a finger into the anus, felt a great hardneſs, whence he had concluded, that the bladder was ſcirrhouſ; which the patient alſo firmly believed, being angry, if I but hinted the leaſt ſuſpicion of a ſtone

(*i*) Ibid. p. 40.

in the bladder. In the body I found the bladder, in the inferior and posterior part, where it laid upon the gut rectum, stretched as it were into a sinus, that contained two stones, one of which weighed thirteen, the other twenty three drachms, they had no prominent angles; were beset with no rugged sharp points; but bore evident marks of mutual attrition: the lesser stone had a pretty deep excavation in its surface, which received the convex prominence of the adjacent larger stone, almost in the same manner as the acetabulum receives the head of the thigh bone. This subject having died during the very efforts he fruitlessly made to discharge his urine, the bladder was so distended, that its bottom reached above five fingers breadth above the *os pubis*.

He voided his urine with difficulty, and not without great efforts, on account of the size of the stones, which prevented the free contraction of the bladder to press out the urine, and of the great quantity of viscid mucus that was squeezed out at the same time; yet the urine was not wholly suppressed, as sometimes happens, when a stone of less size stops up the neck of the bladder, and entirely prevents the exit of the urine, with most excruciating tortures, which cannot be alleviated, unless from the violent strainings the stone is forced through the neck of the bladder and urethra, or is pushed back into the cavity of the bladder, and thus an exit for the urine procured. These pains are so exquisite, that the poor sufferers sometimes lose their senses, nay become raving mad. (k) When the stone is pushed back from the neck of the bladder with a catheter, the bladder being emptied, the patients recover their senses: nay sometimes there is occa-

(k) Ibid. pag. 41.

tion to leave a flexible catheter in the bladder; to prevent the stone from fixing itself again in this narrow passage. Sometimes also calculous patients, when busied in rural employments, have eased themselves by introducing a straw, or bit of hay, up the urethra (*l*); fragments of which if they continued in the bladder might afford a basis for fresh stones; as has been already mentioned at § 1414. Whence Aretæus has said: (*m*) *Sin haud ita magnus sit calculus, lotium frequentius cohibetur: nam facile in cervicem delapsus lotii transitum obstruit; securius autem, quam grandiores, exciditur.* “But if the stone is not so large the urine is more frequently suppressed. for readily slipping into the neck of the bladder it obstructs the passage of the urine; but it is extracted by Lithotomy with greater safety than larger stones.” Presently after he adds: *sed neque dolorum neque gravitatis expertes sunt, licet urinam expedite reddant:* “But they are neither free from pain or a sense of weight, although they may discharge their urine freely:” For this particularly holds good, when the stone in the bladder is too large, to enter the neck of the bladder.

Whence the reason is evident, why calculous patients try various postures of the body, in hopes of finding relief: I have known some stand upon their heads, and move the rest of the body in strange attitudes; and thus sometimes, the situation of the stone being changed, were relieved: and hence likewise we understand, why some can scarce evacuate their urine except when in a supine posture of the body; in such persons the stone does not seem to be fixed in the neck of

(*l*) Ibid. pag. 42. (*m*) De causis et signis Morb. diuturn. Lib. III. cap. IV. pag. 54.

the bladder, but rather a large stone presses against the orifice of the bladder when the patient stands upright, and thus impedes the exit of the urine: for if a stone was impacted in the neck of the bladder, it does not seem that it could easily slip back from a supine posture of the body.

Hippocrates has remarked this, (n) and drawn a diagnostic sign, from the ease received by a change of posture. *Calculosi ita positi, ut lapis ad urinarium meatum non illabatur, facilius mingunt. Quibus autem tuberculum est circa vesicam, quod dysuriam facit, ad omnis generis positiones vexantur; hujus autem solutio fit, pure erumpente.* “ Calculous patients placed in such a position, that the stone does not fall against the urinary passage, make water with more ease. But those who have a tubercle in the bladder, that causes a dysury, are troubled in every posture of the body; but this is resolved only by suppuration.” But how dangerous an inflammation of the bladder is, may be gathered from Hippocrates: (o) *Vesicae durae et dolentes omnino quidem malae, pessimae vero cum febre continua. Nam dolores ab ipsis vesicis ad occidendum sufficiunt, et alvi his non valde dejiciunt. Solvit autem hos urina purulenta prodiens, album ac laeve sedimentum habens. His vero non solutis, et non mollescente vesica, in imprimis circuitibus aegrum moriturum esse, timor est.* “ Schirrous and painful bladders are indeed very terrible and pernicious, but worst of all when attended with a continual fever: Pains of the bladder alone being sufficient to cause death; and the belly at such a time is either bound, or discharges nothing but a little hard stuff, and that by compulsion. A discharge of purulent urine, with

(n) Coac. praenotat. No. 472, 473. Chart. tom. viii. p. 879.

(o) Ibid. No. 471.

“ a white and smooth sediment, carries off the disorder. But if neither the pain remits, nor the bladder grows soft, and the fever remains continually, it is to be feared the patient will be lost in the first periods of the disease.” What violence the bladder must suffer, when its orifice being stopped with a stone, the patient, even against his inclination, is compelled to squeeze out a few drops of urine with prodigious and almost constant strainings, is easily conceived. Sometimes stones of a large size have been thus forced away, especially by women, in whom the urethra is shorter and more distensible than in men. An old woman almost ninety years of age, voided a stone in consequence of such strainings to make water, that weighed above three ounces. The old woman hearty and strong beyond what people usually are at her period of life, had borne courageously the tortures of the stone, for three whole years, and also afterwards supported with equal constancy, a troublesome incontinence of urine, the usual consequence of such an excessive dilatation of the neck of the bladder (p).

And yet the stone not only injures the bladder, but it also sometimes irritates and proves mischievous to other parts, particularly to the gut rectum. *Anus quoque vitii particeps redditur, pruritu laborans : prominet vero et intestinum rectum, vi, contentionibus, imaginatione, perinde ac si jam lapis excernatur. Ambo enim inter se copulantur, anus et vesica, quorum uno affecto, et alterum afficiatur necesse est : ideo inflammato podice, vesica ischuriam patitur, et in vesicae lincinationibus anisi (quae vox cuspidem, aciem, aculeum significat) sedes non dejicit,*

licet alvus sicca non sit. Tales sunt utique ex calculis labores. (*) “ The fundament also shares the
 “ disorder, and is affected with a violent itch-
 “ ing: nay also the gut rectum is forcibly pro-
 “ truded with violent strainings, in appearance
 “ exactly as if a stone was voiding at that in-
 “ stant. For the anus and bladder have a con-
 “ nexion with each other, and when one suffers,
 “ the other necessarily is affected: therefore in
 “ an inflammation of the fundament, the bladder
 “ is subject to an ischury, and in violent acute
 “ pains of the bladder, *αιχμη* (which word signi-
 “ fies the point of a spear, a sting, the edge of
 “ a weapon) the patient has no stools, though
 “ the body is not at that time naturally in a
 “ costive state. Such symptoms then proceed
 “ from stones in the bladder.” A falling down
 of the fundament is frequently observed in chil-
 dren; from those frequent strainings, which a stone
 pressing against the gut rectum excites. But
 when in consequence of the operation, this cause
 is removed, the falling down of the fundament
 usually ceases of itself, or is easily cured by strength-
 ning remedies applied to the anus.

That an hectic fever, and consumption, may
 arise from a stone in the bladder, is easily con-
 ceived: Calculous patients are so affected from
 pain, watchings, grief, perpetual uneasiness of
 mind, the dread of future evils, from which
 they are sensible they cannot be relieved, unless
 by a dangerous and painful operation, that they
 become absolutely consumptive. Moreover it
 was remarked at § 1214, that a phthisis not only
 proceeds from an ulcer in the lungs, but also
 from a like complaint in any of the other viscera;
 where also the phthisis, arising from an ulcer in

(*) Aret. Cappadoc. pag. 55.

the bladder, was mentioned. It was there likewise remarked, that there was greater probability of curing ulcers in the kidneys and bladder, than those of the other viscera; because the purulent matter might more easily be evacuated with the urine, through the passages designed by nature for the evacuation of the urine. Experience teaches this: for we frequently see, after the operation of Lithotomy has been successfully performed, patients worn to meer skeletons, from their continual tortures, in a few weeks recover their former strength, and lustiness, and continue afterwards perfectly healthy. Mean while it is to be considered, that if the free discharge, of the urine and purulent matter, be obstructed, the purulent matter is not only retained, but also mixed with the urine soon grows putrid. If this putridity should be absorbed by the veins, it might infect the whole mass of humours with a cacochymy of the worst kind, or be thrown on some other viscus, and thus in either case, produce an hectic fever, and the most dangerous, namely a putrid consumption.

The patient soon dies in consequence of an ulcer in the bladder, unless he can, and is willing to be freed early from the cause of his disorder by the operation of Lithotomy: but when the kidney suppurates, if a free passage of the purulent matter, is not sufficiently expedited through the ureters, a consumption often ensues, and a lasting one, though the other kidney perfectly sound, nay sometimes enlarged in size, properly secretes the urine, and dismisses it to the bladder. I have seen persons who for two years and above, after every sign of a stone lodged in the bladder, voided purulent matter with their urine, gradually waste away with a continual slow fever, that physicians term hectic. I have known
some,

some, after a long and constant excretion of purulent urine, continue in tolerable health, though there was no longer any appearance of purulent matter in the urine. In such cases, the whole substance of the kidney is frequently consumed by suppuration, so that the external coat only of the kidney remains, but thickened and callous, which contains some stones. I saw an instance of this kind in the body of a man, who lived six years after the suppuration had ended, and enjoyed a pretty good state of health. Many similar cases are to be met with in medical history.

But although persons afflicted with the stone in the bladder, are greatly emaciated in every other part of the body, yet the abdomen often continues fat. In the body of the old man just mentioned, though he had long suffered the torments of the stone, I found, upon making a crucial incision through the integuments of the belly, the fat laying upon the muscles of the belly, a finger's breadth in thickness. The omentum, thick, and extended a little beyond the navel, contained also a great deal of fat. The guts *colon* and *cæcum* had thick adipose fringelike appendages: The *mesentery* and *mesocolon* were extremely fat. However, the liver and spleen were pale, dry, and hard. Morton (*q*) dissected the body of an old woman, who, after having been terribly afflicted for twenty years, at last died of a consumption. He found stones in the gall bladder, the lungs in no part ulcerated, but almost every where beset with hard tubercles and chalky stones: in the left kidney were stones, and cavities from whence stones had formerly fallen into the ureter, but no purulent matter. The right kidney, prodigiously distended, resembled a bag filled with purulent matter and stones, the whole fleshy

(*q*) Phthisiologia, Lib. ci. c. xiv. p. 155.

substance having been corrupted and consumed: this purulent matter was serous, like that which was found in the bladder, and was usually voided with the urine. The internal coat of the emulgent veins was encrusted within-side with a stony matter: but in this calculous subject, *Primum notatu dignum erat, quod, ut ut omnes tabidæ hujus artus atque facies emaciarentur, membrana tamen adiposa abdominis pinguedine mirum in modum crassescibat, uti calculosis accidere solet fere.* “ It was particularly worth notice, that although the face
 “ and every member of this tabid person’s body,
 “ were emaciated to the last degree, yet the adipose membrane of the belly was of a surprizing
 “ thickness, as frequently happens in calculous
 “ subjects.” I have known the same circumstance observed by others.

When a stone in the bladder is, by these most violent efforts, squeezed through the neck of the bladder (namely if it has not yet attained a great bulk) into the urethra, it then in women, as has been already said, is almost always within a short time after voided spontaneously, or by the assistance of art, which is not required to be very great. But in the male sex, this expulsion is attended with far greater difficulty, as the urethra is much longer, and not every where of the same width, and the stone must ascend in order to find an exit. Whence it frequently sticks in the urethra. The proper remedies to relieve this accident, will be laid down hereafter at § 1434.

If a stone fixed in the urethra, fills its cavity in such a manner that the passage of the urine is entirely prevented, a perfect ischury is produced, the bladder becomes mightily distended, and unless this obstacle can be removed, death certainly ensues, as has been said. But where the stone is so placed in the urethra, that the urine
 can

can still slip by, although only in a very small stream, the misfortune will be more tolerable; and frequently may be borne a long time, as we learn from the following extraordinary case.

A man, who in his childhood had undergone the operation of lithotomy, had many years an hard tumor behind the scrotum, situated in the perinaeum, from which he found great inconvenience: for he constantly perceived a pain in making water; which had discharged itself involuntarily by drops, for many years. He found relief when his bladder was distended: but that distension extended through the neck of the bladder and urethra as far as the tumour: Whence he used to drink frequently large draughts of water, or small beer, to obtain some relief from his pain. The patient related, that not long after he recovered from the operation, he began to feel his former complaints, which continued for four or five years, before he perceived a tumour in his perinaeum, which afterwards increased. Twenty years had now elapsed since he had undergone the operation of Lithotomy: At last a frequent vomiting was conjoined with his other symptoms, and for some years past he had been afflicted with a Diarrhæa, which had weakened him very much.

An able surgeon, examining the tumour with his hands, presently judged that a stone was contained therein, but of an irregular shape: he accordingly made an incision through the integuments immediately upon the stone, which he extracted with ease. He now felt another stone that was bifurcated, and could not be extracted without difficulty, because it was to appearance immoveably fixed in the part, and broke during extraction. The surgeon, to facilitate the

ex-

extraction of the stone, having introduced two of his fingers into the fundament, he was astonished to find that one extremity of the bifurcated stone had penetrated into the cavity of the intestine: Moreover the urethra was very much dilated, and grown callous; whence it appeared to the surgeon when he cut through it, as if the knife was forced through a cartilage. The figures of these stones are annexed to this case (*r*). From this extraordinary instance, it is clear, that stones may remain many years in the urethra, and during their stay increase very much in size.

S E C T. MCCCCXXII.

THE stone in the kidneys is known from an obtuse pain in the part, bloody urine after riding over paved streets, and violent exercise of the body, especially riding in a carriage, from frequent voiding of stones, caruncles, purulent matter, and filaments. (1416)

In the Diagnosis of diseases the utmost caution is requisite, that a proper method of cure may be applied, and the reputation of the physician not be endangered, if it should afterwards appear that he has not formed a right judgement of the disease, which he undertook to cure. The stone, while it remains in the kidneys, cannot be discovered by our senses, hence the physician cannot judge of its presence, but from the disorders of the functions, which are observed upon a careful examination. But what caution is ne-

(*r*) Philosophical transactions abridged, tom. III. p. 153.

cessary in this matter, lest a mistake should happen in the Diagnosis, clearly appears, if it be considered, that the parts adjacent to the kidneys when disordered may excite pain, tension, a sense of weight, etc, the cause of which might be judged to lie in the kidneys, unless all the symptoms are carefully compared together. Before, when treating of the nephritis, it appeared, that cholicky pains are sometimes very like those of the kidneys, and the most skilful physicians have sometimes been puzzled in this matter; but without any injury to the patient; as in the first attack of either disease the same treatment is indicated. Galen (s) as has been said on another occasion at § 71. acknowledges that he was deceived in such a case: for he felt a most violent pain, as if an auger was pierced into the bottom of his belly, particularly in that space through which the ureters pass from the kidneys to the bladder: but voiding by stool a transparent pituitous matter, the complaint entirely ceased. The following are his own words: *Equidem putabam, lapidem in altero ureterum impactum; adeo erat, ut mihi videbatur, doloris ipsius species perforanti similis: at, post vacuatum humorem dolore sedato, manifeste constitit, neque lapidem fuisse causam, neque ureteres aut renes fuisse affectos.* “ Indeed I thought, “ a stone was lodged in one of the ureters, the “ pain seemed to me so nearly to resemble the “ boring of that kind of pain: but the pain “ ceasing after I had evacuated the pituitous “ humour, it evidently appeared, that neither a “ stone had been the cause thereof, nor had the “ ureters or kidneys been at all affected.” But although Galen was mistaken in the Diagnosis,

(s) De Locis affectis, Lib. 11. cap. v. chart. tom. vii. pag. 405, & 406.

yet he prescribed such remedies as were of service. It is well known, as will also be hereafter mentioned, that oily clysters are remarkably serviceable in nephritic disorders; whence he directed a clyster of oil and rue to be thrown up the fundament, which brought away the transparent pituitous humour, that was the cause of the complaint, with present relief. In a rheumatic lumbago there is a violent fixed pain about the region of the loins that resembles a nephritic paroxysm. “For besides the intolerable pain
 “near the kidneys, the whole conduit of the
 “ureters even to the bladder, is sometimes af-
 “fected with the same, though in a less degree.”
 (t) Sydenham informs us indeed, that in this disease the patient does not vomit, which symptom always accompanies a nephritic fit. Nevertheless he adds the following sentence concerning this pain: “And I have formerly been led into an
 “error hereby, as imagining it to arise from
 “some gravel lodged in those parts; whereas in
 “reality, it proceeds from the peccant and in-
 “flamed matter of the rheumatism, which affects
 “only those parts, leaving the rest of the body
 “free.” Sydenham was thoroughly persuaded that he had the stone in his kidneys, on account of his having kept his bed a long while in fits of the gout, a sense of weight about the region of the kidneys, and bloody urine which he always made when he rid over the stones in a chariot.

Moreover the celebrated Boerhaave candidly imparted to his pupils, what he had observed in himself. About four o'clock one morning being busied in botanical observations in the botanic garden, the management of which was entrusted

(t) Sydenham, Sect. vi. chapt. v. pag. 272; 273.

to his care, he suddenly was seized with an acute pain, which extended from the region of the left kidney all along the whole conduit of the ureter as low as the *os pubis*, so that he imagined he plainly felt a stone descending from the kidney: an inclination to vomit likewise was an attendant symptom, from which circumstance he was more strongly confirmed in his opinion. The pain continued several days, nor ceased, though he drank very plentifully every day of an emollient decoction: such a constant inclination to make water ensued, that he thought there could not be the least doubt of the disorder's being owing to a stone. But when he judged the passages sufficiently relaxed and lubricated by the free external and internal use of the most emollient remedies, he took a few drops of the Aroph of Paracelsus, of which I have made mention in the chapter on the Small Pox, that by such a powerful stimulus he might expel the loitering, as he thought it, stone; with this effect, that his pains entirely ceased in a few minutes; which however the next day returned again with violence, and lasted three weeks, with some intervals now and then. Attentive to his own disorder, as soon as he got some relief from his pain, he turned over every author both antient and modern, and found that none of them had said any thing to the purpose, except Sydenham alone, who had observed this likewise in his own disease.

If Galen, Boerhaave, and Sydenham, could err in their diagnosis, not concerning patients whom they attended, but in their own cases, what danger of a mistake threatens other physicians, especially such as in an hurry and boldly, declare their opinion, as if they were oracles.

Besides, when Sydenham (*u*) enumerates the various masks under which the Proteus like hysteric passion acts its tragedies, he remarks, “ some-
 “ times this disease seizes one of the kidneys,
 “ where by the violent pains it occasions, it en-
 “ tirely resembles a fit of the stone, not only
 “ with respect to the kind of pain, and the part
 “ affected, but likewise by the violent vomit-
 “ ing wherewith it is accompanied, and the pains
 “ extending through the whole duct of the ure-
 “ ter: the bladder also is occasionally affected
 “ with this delusory symptom, which not only
 “ causes pain, but a suppression of urine, as if
 “ there was a stone, though there is none. This
 “ last species attacking the bladder rarely hap-
 “ pens; but the former more frequently.” He
 likewise remarks, “ that these diseases cannot
 “ without much difficulty be distinguished from
 “ each other, unless perhaps in the hysteric case,
 “ the woman’s spirit having been depressed by
 “ some misfortune a little before the disorder
 “ came on, or a discharge of green matter by
 “ vomit, should shew that these symptoms are
 “ rather to be ascribed to an hysteric disorder,
 “ than the stone: especially if the patient is
 “ greatly debilitated by frequent hysteric fits, and
 “ in a bad state of health.”

On the contrary, stones have sometimes been found in the kidneys, and indeed large ones, which were never suspected to have been there, either by the patient himself, or his physicians. Baglivi relates, that in two bodies he found large stones in the kidneys, though the persons when alive had never been afflicted with pain in their kidneys: the same has been observed by others (*w*). The following case is particularly remarkable. A man

(*u*) Dissertation on Hysteric diseases, p. 412. (*w*) Opera Omnia, lib. 1. cap. ix. p. 118.

twenty eight years of age, had for ten months laboured under a difficulty of breathing, attended with a pain in his breast, a vomiting at intervals, and a sense of weight in the bottom of the belly: various remedies having been in vain tried, he at length died. Manifest causes of the complaints which the poor creature had suffered appeared upon dissection; but besides these, others were discovered, which had never been suspected to exist, and which no ways corresponded with the symptoms of his disorder. For his urine had never deposited any nephritic gravel, he had never complained of nephritic pains, had never been troubled with a suppression of urine. Yet the right kidney was very much enlarged in size, and of a cartilaginous hardness, so that it could not be cut through without difficulty, and contained a large stone that weighed six ounces, which not only filled the whole cavity of the pelvis, and with its inferior extremity entered the ureter, but also with its spreading branches of a very irregular shape filled up the remaining space: this whole mass consisted of an accumulation of nephritic gravel, covered over with a thin bony shell, that in colour resembled white coral. The whole substance of the left kidney was wasted away, and its cells were filled with a greenish fluid. It seems particularly amazing, that these kidneys so greatly disordered, never occasioned the least pain. Houstet, an eminent surgeon (x), in the body of a gentlewoman, who died of a malignant fever, found the left kidney above one half consumed, in the pelvis of which was fixed a triangular stone, lodged in a peculiar cyst. But the lady had never in her lifetime com-

(x) Academie Royale de Chirurgie. t. 1. p. 401.

plained of pains about the region of the kidneys.

Although from what has been hitherto said, it might be concluded, that a certain diagnosis of the stone in the kidneys is not very easily made, yet such symptoms are observed, when a stone is lodged in the kidneys, that although they are not absolutely certain, they raise a just suspicion that a stone is fixed in the kidneys. If then all the symptoms are compared together, which ensue after the first suspicion of a stone, the prudent physician gains an opportunity of confirming the diagnosis already made, or of amending it, provided he has observed these circumstances with attention. It is well known, that the stone sometimes is observed to afflict particular families, as an hereditary disorder. It has been mentioned before, at § 1414, that those, in whom the elementary principles of the stone, dispersed through the urine, soon unite, and form nephritic gravel, are more subject to calculous disorders than others. If therefore any person born of calculous parents, should frequently void gravel or small stones by the urinary passage, it is then certain that a calculous disposition exists in such a person. If a sedentary life, great corpulency, or long lying in bed, from a fracture, the gout, or other causes, should afterwards accede thereto, the sagacious physician is sufficiently satisfied, that a renal stone is to be apprehended. If afterwards other symptoms occur, that usually accompany a stone in the kidneys, he then can with certainty affirm, that the patient has a renal stone: for he does not then form his judgment from one or another particular symptom, but from the concurrence of them all, and the order in which they mutually follow each other; which here is particularly to be noticed.

Moreover

Moreover the utmost attention ought to be paid to the symptoms that appear while the stone still lies quiet in the kidneys, and to those which happen in consequence of the stone's being moved, which often are wholly different from the former: if a stone is formed in the kidney, and has already acquired any size, the patient frequently perceives a sense of weight, and a dull heavy pain in the region of the affected kidney: if the stone is angular, the patient generally feels a pricking pain, especially when the body is suddenly bent forwards; the cause of which is pretty evident. Then an inflammation of the kidney, and all its consequences are to be feared. But if the stone is large, and not of an angular or very rugged form, it may lie quiet in the kidney a great while, and prove but slightly troublesome by a dull heavy pain alone. This Sydenham, experienced in himself (y) after having been constrained from a severe fit of the gout, to lie constantly in or upon a soft bed for two months together: for he began to feel a dull heavy pain, especially in the left kidney, and sometimes though very seldom in the right. The pain attacked him only at intervals, and was not sharp but bearable: for he had never yet had a single fit of the stone, which is attended with severe pain along the ureters, and violent vomiting: whence he rationally judged, "that he had a large stone in the pelvis of one of them, which being too big to pass into the ureter, occasioned the above mentioned symptoms, and did not bring on the last." For the stone laid quiet, and the last enumerated symptoms are produced from the stone's being moved, whence we understand, why large stones may remain a long while in the kidneys, without causing

(y) On bloody urine from the stone, &c. p. 583.

much disturbance, while small ones, if removed from their situation, excite severe pains, &c.

Sixteen years after Sydenham had perceived the first symptoms of a renal stone, having walked considerably, and for a long time, he made bloody urine: the same afterwards frequently happened, “whenever he walked much, or was
“carried in a coach over the stones, though the
“horses went slowly; but this symptom did not
“seize him, when he travelled in a coach on unpaved roads, how long a journey soever he
“made.” The urine he voided on these occasions, though when first made it resembled pure blood, yet soon after became clear at the top, like natural urine, the blood falling to the bottom by itself in clots. It is easily conceived, that from violent exercise of the body, and especially from the constant jolting of a carriage in rough roads, or riding on horseback, the hard stone may injure the adjacent vessels of the kidneys in such a manner that an hemorrhage may ensue: if the blood is quickly voided with the urine, it is of a vivid colour, but if it is retained some time in the bladder, a dark brown turbid fluid is evacuated resembling coffee, the blood being now changed from its stay, and mixture with the urine. If such urine is voided, after a sense of weight, or of a dull pain in the region of the kidneys, and a slight nausea after violent exercise, a renal stone may be justly suspected.

Whence bloody urine is not without reasons enumerated among the signs of a stone in the kidneys, since it frequently happens from that cause: but bloody urine alone, if other symptoms of the stone are absent, cannot be considered as a certain and pathognomic sign of the stone; for bloody urine is observed to be voided from other

causes.

causes. Hippocrates has made the following remarks on bloody urine: *At sanguinem mingere, raro quidem, et sine dolore, ac febre, nihil mali significat, sed lassitudinum solutio fit. Si vero sæpius mingat, et aliquid ex his accesserit, malum est. Verum prædicere oportet, siue cum dolore mingatur, siue cum febre, fore, ut insuper pus mingat, atque ita dolores quiescant (z).* “To make bloody urine, seldom, and without pain, or a fever, is of no bad consequence, but causes a solution of the complaints. But if it is made frequently, and one or other of these come on, it is dangerous. Indeed it behoves us to prognosticate, whether it is voided with pain, or with a fever, that the patient may moreover make purulent urine, and thus the pains be abated.”

For when it happens without pain or feverish complaints, in such case the plethora is resolved, and the lassitude, and torpor of the whole body, which are usually the attendant symptoms of a plethora, are removed: but such an hemorrhage from the kidneys seems to proceed from the anastomoses of the vessels alone, without a rupture of the vessels. Aretæus writes (a) *Nonnulli sunt, qui per circuitus sanguinem mejunt: hujusmodi affectus hæmorrhoidum profluvio similis est: similis quoque est corporis constitutio.* “Some persons make bloody urine at particular stated times: a disorder of this kind is like the bleeding piles: the habit of body is also similar.” In another passage he says (b): *Nonnunquam e renibus sanguis multus subitaneus erupit, multisque diebus continenter effluxit: verum nemo ex tali hæmorrhagia moritur, sed a phlegmone, quæ simul cum sanguinis profluvio nascitur, si sanguis inhibitus fuerit. Plerumque autem ex retentione,*

(z) Prædict. lib. 11. c. iv. chart. t. viii. p. 113. (a) De causis et signis morb. diuturn. lib. 11. c. 111. p. 53, 54.
(b) De causis et signis morb. acut. lib. 11. cap. ix. p. 22.

quam ingens plethora facit moriuntur. “ Sometimes
 “ a quantity of blood suddenly issues from the
 “ kidneys, and continues to flow for some days :
 “ but no one dies of such an hæmorrhage, but
 “ from a phlegmon, which is generated at the
 “ same time with the discharge of blood, if the
 “ hæmorrhage is stopped. But many die from
 “ the retention, which a great plethora causes.”
 Thus the assertions of Hippocrates are strongly
 confirmed ; for if bloody urine is made without
 pain or a fever, which are signs of an inflamma-
 tion, no ill consequence is to be apprehended, if
 the disorder happens but seldom. For although
 such an hæmorrhage proceeds from the dilated
 mouths of the renal vessels, yet if this frequently
 happens, there is danger lest these vessels should
 be so weakened, that afterwards from the fre-
 quent copious hæmorrhage, the vital powers being
 debilitated, other disorders ensue. Aretæus de-
 scribes those which are to be apprehended in
 persons who make bloody water at set intervals :
Nam valde pallescunt, torpent, ignavi sunt, cibos
fastidiunt, cruditate laborant, et, quum excretus est
sanguis, languidi fiunt, membra resolvuntur, caput
vero levius et agilius redditur. “ For they are ve-
 “ ry pale, faint, and sluggish, loath their food,
 “ and are troubled with crudities ; and when the
 “ blood is excreted, they become languid, and
 “ the limbs are relaxed, but the head is rendered
 “ lighter and more brisk.” From which it ap-
 pears that frequent hæmorrhages from the kid-
 neys are by no means desirable ; especially if
 they return at a stated period, for then there is
 danger, lest, from too great a loss of blood, the
 body be rendered cachectic, or if such a periodi-
 cal evacuation is suppressed, other and grievous dis-

orders ensue. *At si per circuitum nihil sanguinis effluxerit, capitis dolore vexantur, oculorum acies hebet, tenebræ eis obversantur, vertiginem patiuntur: inde milleni alii in morbum comitialem incidunt, tumidi, veluti caligine perfusi, aquam inter cutem patientibus similes (d).* “But if no blood should be discharged at the stated period, they are afflicted with “headachs and vertigoes, the eyes look dull, and “the sight grows dim: and hence some are seized with the falling sickness, tumefied, as if “wrapped in a mist, like patients who have water between the skin.” However, it is a certain known fact, that periodical evacuations, when suddenly stopped, rather affect the head, than other parts of the body.

The renal tubes, that secrete the urine in the kidneys, seem easily to be so dilated, as to transmit blood, from the increased impetus of the fluids through violent exercise or strong concussions of the kidneys. I have frequently seen persons make bloody urine after having rode in a carriage that has been drove hard over the stones, or after hard and constant riding on horseback, in whom neither before or afterwards there ever was the least reason to suspect a renal stone: in such cases the urine indeed is usually tinged with blood, and sometimes pretty deeply tinged, but grumous blood is seldom or never voided with the urine: hence the anastomoses of the vessels alone are in this case supposed to be the cause of the hæmorrhage. For it is observed, that persons, when they ride in a carriage, make water more frequently than at other times, whence it appears, that more urine is secreted, and therefore that the fluids are applied to the secreting vessels with an increased momentum of force;

(d) Ibid.

whence a dilation of these vessels ensues; and if the diameters of these vessels are sufficiently enlarged to enable them to admit the red part of the blood, the urine will be rendered bloody.

This disorder is easily cured by rest of body alone, and an emollient diet. However the patient is likewise to be directed, to avoid in future all violent concussions of the kidneys, which advice is generally readily complied with, as most persons are greatly frightened at the sight of bloody urine.

The danger is greater, if from the like causes vessels are ruptured in the kidneys: but in this case there is frequently pain. *Oritur autem morbus a vehementi labore, quum venulæ adrenem tendentes ruptæ fuerint deinde ren sanguine repletus exstiterit. Quum his æger affectus fuerit, per initia sanguinem cum urina mingit, deinde pus progressu temporis. Hic, si corpore quieverit, citissime convalescet. Si quid enim laboravit, dolores multo magis detinebunt.* “ But the disorder arises from hard labour, when the small vessels of the kidneys are ruptured, and the kidney remains filled with blood. When a patient is afflicted with this disorder, at first he voids bloody urine, and afterwards, in process of time, purulent matter. If such a person keeps himself perfectly still and quiet, he very quickly gets well: but if he works, his pains will continue much longer” (e). For in this case, there is a wound, which as it is recent, there are hopes, that it may be soon healed, especially by means of rest; if it is neglected, it threatens danger of inflammation and future suppuration.

It is evident, that a far more violent hæmorrhage from the kidneys is then to be apprehended, whence Aretæus has said; (f) *Nonnunquam et ex*

(e) Hippocrates de intern. affect. cap. 17. chart. tom. vii. p. 649, 650. (f) De causis & signis morbor. diuturn. cap. 111. p. 54.

renum disruptione sanguis fertur multus collectim; verum cogitur, et in grumos densatur, utque in sanguine extra corpus effuso fieri solet: interdum etiam et in vesica coagulatur, quando atrociter urina supprimitur: ruptionem vero ulcera diuturna atque vix sanabilia sequuntur. “ Sometimes also from a rupture of the vessels in the kidneys a quantity of blood is collected; but it is curdled and condensed into grumes, as is usual with extravasated blood; it is also sometimes coagulated in the bladder, when the patient labours under a total suppression of urine: but lasting and almost incurable ulcers ensue in consequence of a rupture of the vessels.” I was witness of such an hæmorrhage from the kidneys in an equerry, who took delight in managing the most spirited and vicious horses; within the space of a few hours he voided by the urinary passage above eight pints of fluid blood; and afterwards grumous blood was squeezed out with great pain. By absolute rest of body, and proper remedies he escaped this imminent danger, and lived several years after comfortably. But slighting my advice, and confiding in his strength and agility, he exposed himself every day to the same perils, until he was seized with a like, nay greater and more lasting hæmorrhage, and from such a great loss of blood died dropical: before his death there were likewise signs of a suppuration in the kidneys.

When from a rupture of the vessels of the kidneys, the blood is rapidly impelled into the bladder, it is usually voided in a fluid state; but towards the end, the hæmorrhage being now greatly diminished, or quite stopt, the blood coagulates into grumes, and is voided with difficulty, nay sometimes causes a dangerous suppression of urine. But if the blood slowly drops from the kidneys, through the ureters, into the bladder, it

will remain there a long while, will coagulate, and still ductile, be squeezed through the urethra in the form of a thick thread, sometimes extended to an extraordinary length. A remarkable case of this kind is related (g): A man about fifty, of a sanguine habit, but melancholic, was attacked with a stroke of the palsy, of which he perfectly recovered. For many years he voided gravel with his urine, and sometimes an ounce at a time: after having used violent exercise he was seized with a suppression of urine, attended with an acute pain quite to the extremity of the urethra: not long after a blackish substance began to issue from the urethra, about the thickness of a pen, in its shape resembling a worm; which being cautiously extracted, measured full twenty inches in length, and immediately was followed by a plentiful discharge of bloody urine. Within a quarter of an hour after, a like concreted substance made its appearance an ell long: afterwards for the space of four nights and days, every half hour similar concretions were voided of various lengths: the longest measured full twelve ells. The colour was a very dark brown; but from the accession of air became more vivid, and by degrees changed to the colour of blood: he preserved these substances in spirits of wine, but they thereby acquired a great tenacity. The celebrated Tronchin, who sent an account of this case to the Royal Academy of Paris, at that time practising physic in Amsterdam, shewed me this excreted substance, made me a present of a part of it, and likewise related to me the whole case. The length of all the pieces that were voided was equal to eight hundred and twenty five Dutch ells. They were excreted with very little pain; sometimes also blood

(g) Academie des Sciences 1735. p. 25.

issued through the urethra. He likewise added, that before this amazing excretion, in consequence of a very great uneasiness of mind, the customary expulsion of nephritic gravel had ceased an whole year, which had been sometimes so copious, that he had once voided an ounce and an half at the same time.

I have seen since a similar case in a man upwards of sixty, who in other respects had enjoyed an excellent state of health: he began to make bloody urine at times, afterwards he voided concreted substances like those above described, through the urethra, but not of so great a length, as they never exceeded the measure of a foot, the whole quantity excreted, summed up together, also by no means came near that of the foregoing case. He sometimes also voided white convoluted pellicles, which in shape resembled the round worm, but when macerated in water, and unrolled, were membranaceous, very like ruptured hydatids, such as I have sometimes seen in the kidneys of calves. Twice or thrice he voided a white substance, round likewise; which covered over with a thin membrane, was within side fungous. The patient having entirely lost his appetite, gradually decayed, and at length died, nor could I by any means obtain liberty to open the body.

But these are the principal signs of a stone in the kidneys, of the different certainty of which mention has been already made, and from the concurrence of which especially, a diagnosis ought to be formed. If the patient has voided stones, or nephritic gravel with his urine, the other signs acquire a greater degree of certainty. The purulent matter and caruncles, that denote a suppuration made in the kidneys, have already been treated of in § 1416. Filaments like hairs, swimming in the urine, are also usually reckoned among

among the signs of renal stones. Hippocrates says (b) *Quibus cum urina crassa exiles carunculæ, aut veluti capilli, simul exeunt, illis a renibus excernuntur.* “Where small caruncles like hairs are voided with thick turbid urine, in such persons they are excreted from the kidneys.” Galen in his commentary on this passage affirms (i), that he frequently, as well as other very eminent physicians, had seen such filaments in the urine, moreover, that this complaint was called *trichiasis* by the modern physicians of his time, *quod villis præsertim albis ea, quæ per urinas feruntur, similia appareant.* “Because these substances that floated in the urine, vastly resembled white hairs.” He then adds, *quod quidam ejusmodi corpora tam longa mejebat, ut incredibili longitudine viserentur: Quædam enim ex ipsis ad dimidium cubitum extendebantur:* “that a certain person voided with his urine, substances of this kind of an incredible length: for some of them measured half a cubit.” He remarks likewise, that all who voided such filaments, had lived upon eatables that afforded a viscid juice, and were cured by a change of diet, joined to attenuating and inciding medicines. Whence he extols (k) the sagacity of Hippocrates in simply saying: *a renibus excernantur. Non quod eorum sit substantiæ particula, sed quod in ipsis suam compagem sit sortitum. Exiguæ itaque carunculæ exulceratorum omnino renum substantiæ partes existunt; quæ vero pilis sunt similia, in renibus quidem suam compagem accipiunt, ut et lapides, sed eorum substantiæ partes non sunt:* “they are excreted from the kidneys. Not that they are part of their substance, but that they are formed therein. Little caruncles therefore are part of the substance of kidneys

(b) Aphor. 76. sect. iv. chart. tom. ix. pag. 186. (i) Ibid.
 (k) Ibid. pag. 187.

“ entirely ulcerated; but those which resemble
 “ hairs, indeed receive their frame in the kidneys,
 “ as stones also do, but are not part of their sub-
 “ stance.” Whence Galen has attributed the
 origin of these filaments to a mucous or pituitous
 humour. But Ægineta (*l*), who likewise takes no-
 tice of these little hairs in the urine, rather thinks
 them excreted, when the kidneys are in an ul-
 cerated state.

The learned Dr. Clerk communicated the fol-
 lowing observation to the celebrated Pringle (*m*):
 namely, that in the urine of persons labouring
 under an erratic gout, certain filaments often float,
 which though less transparent than urine, yet when
 taken out of it are pellucid as chrystal, may be
 drawn out into a great length, and when dried
 become a whitish calx. This the doctor thought
 the cause of the disease in the gout, stone, etc.
 and also supposed this to be the *vitreous pituita* of
 the antients. It is remarkable that Sydenham and
 Boerhaave were both deceived by a gouty pain;
 and Galen was relieved by the voiding of a vitre-
 ous pituita, from a violent pain, that he attributed
 to a renal stone descending through the ureter.
 Storck (*n*), principal physician to the Imperial
 court, who cured such a most violent pain, that
 had seized the whole right side, and for above
 three months had resisted the power of medicine,
 by the extract of Aconite or Wolfsbane, remarked
 besides copious sweats, sometimes very foetid, *uri-*
nam fluere copiosius, et multa gerere flocculamenta, et
fila mucosa, “ the urine to flow plentifully, and to
 “ contain many filaments and mucous threads.”
 These will be spoken of more fully hereafter, when
 we treat of the Rheumatism. I here only propose

(*l*) Lib. iii. cap. 45. pag. 46. (*m*) Diseases of the Army,
 page 187. (*n*) Libellus de Stramon, etc. pag. 77.

as a doubt, whether such filaments appearing in the urine, may not more frequently proceed from such a cause, than from a disorder in the kidneys, ureters, or bladder.

We shall next consider the attendant symptoms when a renal stone begins to change its situation, and attempts to pass into the pelvis or ureter. For hitherto we have principally treated of those which are observed, when the stone lodges in the kidney, in a quiescent state. Sydenham remarks (*o*) that a large stone in the kidneys, which has already grown too big to pass through the ureters, will lie quiet, and often continue a long time in the body without creating much uneasiness; or at least if it causes pain, the pain will be very bearable. This he experienced in himself and in others: many cases have already been cited of persons, who never suspected they had the stone, yet in whom after death a large stone was found in their kidneys; nay, several stones have been sometimes found, but smooth, not angular: but smaller stones conveyed into the pelvis, and beginning of the ureter, excite great commotions; vomiting, gripes, pain, fever, etc.; until by so many repeated strainings to vomit, and so many motions of the body, which the patient tries to procure relief from his pain, at length the stone gets into the cavity of the bladder. This is called a fit of the stone; which as Sydenham had never experienced, he concluded from other symptoms, that he had a stone in his kidneys, but that it was too large to pass through the ureters.

For then human nature as if vanquished, remains quiet, nor exerts powerful endeavours to expel the noxious substance: it has already ap-

(*o*) Dissert. on bloody urine from a stone, etc. page 583, etc.

peared in the history of fevers, that when any thing noxious is to be expelled out of the human body, shiverings, rigors, tremors, nay and even convulsions are often excited: thus when any thing that oppresses the stomach is about to be thrown up by vomiting, the lips begin to tremble, and especially the under lip. Hippocrates says (p): *Tremores senioribus in febre (fiunt) atque sic comparentes, fortassis lapillos per urinam ejiciunt.* “ Trem-
 “ blings happen to old people in fevers; and
 “ when they are thus affected, perchance they void
 “ small stones by urine.” And in the preceeding paragraph (q): *Renum dolor repentinus cum urinæ suppressione, lapillorum, aut urinarum crassarum mictionem significat.* “ A sudden pain in the kidneys,
 “ attended with a suppression of urine, denotes
 “ the voiding of small stones, or thick turbid
 “ urine.” But it seems especially worthy of notice, that in both these texts Hippocrates uses the diminutive word (λιθιδίων) as if he meant to indicate that these commotions were excited by small stones only; and also by other causes, that oppress and irritate the kidneys, and are expelled by thick urine. I was amazed at the sagacity of Hippocrates, in the case of a corpulent robust man, who had before frequently voided renal stones, attended with the usual symptoms. When I first visited this patient, I found him feverish, he complained of a pain about his left kidney, that reached all along the course of the ureter; and likewise of frequent reachings to vomit. The patient having been before frequently attacked with the same symptoms, positively asserted that a stone was passing through the ureter: nevertheless he soon began to void a great quantity of thick

(p) Coacar. prænot. No. 590. Chart. tom. viii. pag. 887.
 (q) Ibid. No. 589.

urine, and quickly recovered without voiding a stone.

Physicians were astonished, that from the passage of a small stone through the ureter, parts remote from thence, should sometimes suffer grievously, the testicle and scrotum of the same side be affected, the thigh grow numb, tremble, and become painful. Hippocrates enumerates most of these signs (*r*), when small stones, like gravel descend from the kidney towards the bladder. *Dolor, acutus in renem et lumbos, et in testem ad renis regionem, incidit, frequenter urinam reddit, et paulatim urina supprimitur, et ubi per urethram arena exit, vehementem in urethra dolorem exhibet. Quum autem ipsam cum urina rejecerit, remittit dolor; deinde sursum in iisdem jacet doloribus. Quum vero urinam reddit, eam etiam prae dolore fricat.*

“ An acute pain in the kidney and loins happens, the patient has a frequent inclination to make water, and by degrees a suppression of urine comes on, and when the gravel is making its exit through the urethra, he feels a violent pain in the urethra. But when he has voided it with the urine, the pain ceases; he afterwards again is seized with the same pains. And when he makes water he also rubs his yard, on account of the pain.” But as many physicians, from observing the symptoms, concluded that the bladder was affected with a stone, he warns them: *Haec autem (vesica) minime, sed ren calculo laborat.* “ It is not the bladder, but the kidney that is afflicted with a stone.” In another place, to these he adds another symptom (*s*): *stuporem nempe femoris ejusdem lateris.* “ Namely, a numbness of the thigh of the same side.”

(*r*) De affect. intern. Cap. xv. Chart. Tom. vii. pag. 649.

(*s*) Epidem. vi. Text. vi. Chart. Tom. ix. pag. 836.

Hippocrates in this place treats of the stone in the kidneys, and remarks that, after the contents of the stomach are thrown up, such persons vomit a greenish humour, when the pains are very violent. But it has been already observed, that Sydenham enumerates a bilious vomiting, among the principal signs of a nephritic fit.

Aretæus (1) describes the signs of a moved renal stone in the following manner. *Quod si aliquando grandior effectus, lapis concavo renis inhaerit, hunc dolores lumborum, circa musculos, quos Psoas appellant, excitantur, et ad medias usque costas perveniunt. Multis certe dolor ille, ac si pleuritis esset, imposuit: præterea gravitas adest coxendicis: dorsum aegre incurvatur: difficulter annuant etc: sin autem in ureterem lapis inciderit, concussio corporis fit, ut in rigore: calculi progressus sentitur cum violenta contentione (sic celeberrimus Petit legendum voluit (u) ξὺν τῷ Βαίῳ loco ξυνῷ ὁμοσταίῳ). “Where-
 “ as if sometimes, the stone grown larger, should
 “ stick in the concavity of the kidney, in such
 “ case pains in the loins, about the Psoas muscles,
 “ are excited, and reach as high as the middle
 “ ribs. Indeed, this pain so much resembles the
 “ pleurisy, that it has deceived multitudes: be-
 “ sides there is a sense of weight in the hip: the
 “ back is bent with much difficulty: the patient
 “ also cannot nod his head without difficulty,
 “ etc: But if the stone has fallen down into the
 “ ureter, the body quakes as in a rigor: the pro-
 “ gress of the stone is felt with violent strain-
 “ ings.” (According to the celebrated Petit,
 who would have us read ξὺν τῷ Βαίῳ, instead of
 ξυνῷ ὁμοσταίῳ) *Quod si in vesicam delapsus fuerit,
 lotium aquosum uberius effunditur: alvus dejicit:**

(1) De causis et signis Morbor. Diuturn. cap. 111. pag. 53.

(*) Ibid. pag. 197.

flatus inde exhalant : extentus stomachus est : ruētus eduntur : a prioribus malis quies datur. “ But if
 “ the stone has slipped into the bladder, an
 “ aqueous urine is discharged plentifully : the
 “ patient has stools, and breaks wind down-
 “ wards : the stomach is distended : the patient
 “ breaks wind upwards also, and is relieved from
 “ his former complaints.” And Ægineta takes
 notice of the pain in the testicle, and numbness
 of the thigh of the same side, where he speaks of
 the signs of a stone in the kidney. (w)

That the kidneys have a strong connexion with
 the genitals, is a fact which is generally allowed ;
 whence Celsus speaking of the signs of a wound-
 ed kidney, (x) says, *Renibus vero percussis, dolor
 ad inguina testiculosque descendit.* “ When the
 “ kidneys are wounded, the pain reaches to the
 “ groin and testicles.”

A man, subject to a calculous nephritis, had
 the left side of the scrotum painful, together
 with a slight swelling of the testicle of the
 same side ; however these symptoms quickly dis-
 appeared. Three days afterwards he was seized
 with a sudden violent pain in the hind part of
 the left ilion ; the slightest touch increased the
 pain to such a degree, that the patient could not
 help roaring out in a shocking manner ; he had
 also a strangury ; the urine was limpid and colour-
 less ; and the pain was augmented by the least
 motion of the body.

The abdomen began to grow tense ; the patient
 broke wind upwards and downwards ; all these
 symptoms continued for five days ; and the pain was
 not only increased from the gentlest touch, and
 the least motion, but even if he spoke. He then

(w) Lib. III. cap. xlv. pag. 46. (x) Lib. v. cap. xxvi.
 No. 11. pag. 286.

began to feel an uneasy painful sensation about the nut of the yard, and a great strangury; the following day, which was the sixth from the first attack of the fit, the pain in the hind part of the left ilion almost wholly vanished; the next day being the seventh, the part was entirely free from pain, even though roughly handled; on the ninth day he voided by the urinary passage a great many small stones.

In a woman of a delicate constitution, descended from a calculous mother, I observed a pain that extended from the loins to the left ilion, which she imagined, proceeded from her having caught cold: Moreover she voided brownish, foetid urine, with an admixture of caruncles. I acquainted her that I suspected a renal stone was moved from its place of residence; which the patient would not believe: on the fourth day she was seized with a violent pain in the left side of the abdomen, and a very troublesome strangury: when she attempted to lift her left thigh and leg the pain encreased immensely: the urine was limpid, and the same day in the evening became higher coloured; afterwards turbid, and the pain greatly abated: but the strangury still continued, though less violent than before.

After a good night's rest, she the next morning voided by the urinary passage a triangular stone, the angles of which were very acute, from which she found great relief: for two days afterwards she made turbid urine, which contained white gravel and a quantity of nephritic sand, and at length perfectly recovered; so that for several years after she found no return of her disorder.

I have sometimes known an intolerable pain arise about the spot where the seminal vessels pass through the abdominal muscles, in their way

to the scrotum, which upon the stone's being voided, instantly went off.

I have known it happen, that a most acute deep seated pain has arose in the groin near the pubes, which was communicated to the adjacent thigh and leg without any swelling, and tormented the patient night and day, for two months together and above, though the most able physicians, in consultation, had tried every method to relieve the patient. Then follows an acute pain upon the crest of the left ilion: large stones very acute, are voided with the urine; and all these symptoms cease.

From all which circumstances it is evident, that the stone, when it passes from the kidney, through the ureter, into the bladder, or sticks in this passage, not only affects the parts through which it passes, but may also produce surprising evils in other parts, and indeed different ones in different persons, as Piso has justly remarked, who was himself often afflicted with nephritic complaints from renal stones. (y) He says, the descent of a renal stone through the ureters may be known by the following symptoms: *Scilicet, praeter communia signa ante descripta, revulsione testiculi respondentis ureteri contracto, stranguria, et saltem, pruritu in glande, ac frequenti saepe mictione, tum vero stupore quodam seu tremore cruris respondentis pariter reni, seu ureteri contracto, denique frigore extremarum partium infernarum. Quae sane symptomata, tametsi non perpetuo in omnibus, tamen semper in me sum expertus, sed in descensu per ureterem lapilli, quo tempore scilicet maxima est ureterum in se contractio.* “That is to say, besides “the usual symptoms before described, by the “revulsion of the testicle on the same side as the

(y) De colluv. Seros. Sect. iv. cap. 11. pag. 301.

“con-

“ contracted ureter, a strangury, and also by an
“ itching in the nut of the yard, and often by
“ the frequent inclination to make water, and also
“ by a numbness or tremor of the leg on the
“ same side as the kidney or contracted ureter,
“ lastly by the coldness of the lower extremities.
“ Which symptoms indeed, though they are not
“ constantly met with in every one, yet in my
“ own case I have always felt them, but in
“ the descent of a small stone through the ure-
“ ters, at which time, the contraction of the
“ ureters is greatest.”

Some more uncommon symptoms sometimes accompany the stone in the kidneys; which therefore scarcely deserve to be reckoned among the diagnostic signs of a renal stone, being so very seldom met with; however it can do no harm to remark them, since they occur. In a youth, who had every appearance of a large stone's being lodged in his kidney, the testicle of the same side began gradually to waste away, so that at length scarcely the least remains of it could be felt in the scrotum. Douglas, an eminent Scotch surgeon, observed the following circumstances in a robust man, who from four years of age had been afflicted with a violent pain in his right side about the region of the kidney; and after whose decease, aged 53 years, two stones were found in the right kidney: (z) He was never at any time perfectly free from this pain; but he often had tolerable intervals. When the pain was very violent, he seldom got relief from any thing, but the drinking large draughts of warm water, sometimes even to the quantity of twelve pints. He more than once suffered such continual pain for some months, that he was obliged

(z) Medical Essays, Vol. 1. cap. xxi. pag. 231, etc.

to lie the whole time on a coverlet laid on the floor; the pressure of his pained side on the hard floor giving him some remission from pain. Moreover this circumstance was particularly remarkable, that while the pain continued, all the urine he passed, after it had stood and cooled a little, became like whites of eggs; though he drank large quantities of warm water to alleviate his pain, and as small beer rather eased him, he for ordinary drank plentifully of it. He had often a diarrhoea, but without gripes; and could at pleasure, even then refrain going to stool for an whole day. And in like manner, he could retain his urine, till his bladder was so full, as to discharge near six pints at once.

Now the following are the most obvious signs of a stone in the kidney moved from its place. There frequently arises a sudden pungent pain rather in the side, than in the back, attended with nausea, vomiting, inquietude, and a perpetual changing of the body from place to place.

These signs denote that the stone is not over large, and has arrived at the membranous streights of the pelvis: for large renal stones indeed bring on bloody urine, upon the patient's using bodily exercise, or riding in a carriage, but do not excite a nephritic fit. The more violent these fits are, the greater reason there is to expect a speedy deliverance from them. The methods then most proper to be taken, will be hereafter shown, when we treat of the cure of the stone.

S E C T. MCCCCXXIII.

THAT there is a stone in the bladder is known, from the pain both before, in, and after making water; from
the

the urine being discharged only by drops, white, with mucous, thick, heavy sediment in great quantity; from an itching at the head of the yard, from a tenesmus at the time of making water, by introducing the fingers up the fundament, by examining the bladder with a sound, and by the symptoms described at § 1421.

It is not so easy a task to distinguish a stone in the bladder, as it seems at first sight to the less experienced practitioner. For I have known the most experienced Lithotomists puzzled a great while, nay some have ingenuously confessed, that they have been mistaken, as many symptoms, that are reckoned signs of a stone in the bladder, may be produced also by other causes: hence the utmost caution is always necessary, and a careful examination of all and every of the symptoms that occur in the present patient, before the operation of Lithotomy be attempted: for this operation is justly considered as one of the most difficult in the whole art of surgery; nor is it free from danger, though it is so often performed successfully by skilful operators.

Besides it is universally known, that cutting for the stone cannot be effected without great pain to the patient. Whence in many places, it is enacted by the laws, that this operation shall not be attempted, without permission first obtained from a magistrate, who deposes the physician and surgeon, retained for this purpose by an annual salary from the government, to search the patient before the operation is undertaken. This precaution formerly was extremely necessary, as too often strolling pretenders, for the sake of

gain, attempted this difficult operation with their slovenly hands, with impunity, such people are wont to do, sporting with the lives of their fellow creatures, and sometimes, cruelly substituting stones, which after the operation they falsely swore they had extracted from the bladder.

In the preceeding pages an instance or two of such wicked impositions have been related, and many similar cases are to be found in medical history. The signs were likewise there given, by which human stones may be distinguished from other stony concretions. But even this will not suffice, if such artful impostors should carry about them a real human calculus, and suddenly expose it to the unwary spectators, bedewed with the blood of the recent wound.

But enough of such villainy: it is certain that the most experienced have found difficulty in the diagnosis of the stone in the bladder. Denys acknowledges, that he was sent for to a man, who for several years had laboured under every symptom of a stone in the bladder, and indeed so severe, that he could not think there was occasion to introduce a sound, in order to search the bladder for a stone: and advised the patient, to be cut as soon as possible, that he might get rid of his complaints. However he attempted to search him, but could not introduce the instrument into the bladder; to discover the cause of which, having put one of his fingers up the fundament, he felt the gut *rectum* compressed by a large hard tumour, as if the whole bladder was ossified. (a)

He then attempted with all his force to push a catheter into the bladder; which was suddenly

(a) Aanmerkingen over den Steen, cap. 11. pag. 43.

effected;

effected; but immediately purulent matter issued out through the hollow tube of the catheter, to the amount of almost a pint and a quarter; and after a very careful examination of the whole cavity of the bladder, Denys at last could find no stone. The patient indeed promised to return, that he might be cured of the ulcer in his bladder; but did not keep his word. About a year afterwards he saw the same person, in good health, and free from all pain and difficulty in making water; so that he could follow his usual employments.

Moreover he advises us, that sometimes instead of a stone, he has found the whole internal surface of the bladder callous, nay cartilaginous; and adds that he had most frequently found this in women, who were thought to have the stone.

(b) I visited with this eminent Lithotomist a maiden, forty years of age, in whom we perceived many signs of a stone in the bladder. Upon his trying to pass a catheter, he perceived an hard substance in the vagina: the patient who had concealed this complaint, now confessed, that she had worn a pessary for a bearing down of the womb; which a midwife had given her, and was made in a clumsy rude manner: this being removed, and the catheter introduced, no stone could be felt; but he found the neck of the bladder entirely schirrous. In a patient, who had been afflicted with most, if not every symptom of the stone, after his death the bladder was found schirrous, hard, and white, and not only filled the whole pelvis, but rose some fingers breadth above the *os pubis*, nearly equalling in bulk the head of a young child: in the middle of this tumour a small cavity still remained, hardly capable

of containing an hazel nut: the ureters indeed, distended throughout their whole length, were equal in diameter to a man's little finger; but neither in them, in the kidneys, or in the bladder, was sand, or the least sign of a stone found. (c)

In an old man, who had often complained of the symptoms that usually accompany a stone in the bladder, and who at last was afflicted with an obstinate suppression of urine, the kidneys were found perfectly sound; but above ninety stones were lodged in the bladder, all smooth and roundish, each a little bigger than a vetch.

At the same time, and in the same hospital, there was another old man, who laboured exactly under the same complaints as the former; but in his body no stones at all were discovered, but a pretty large ulcer principally situated on the inferior part of the urinary bladder. (d) In the body of a man about forty, who after an inflammatory nephritis, had been afflicted with an abscess in his left kidney, and had for a long while voided purulent urine, many rugged, angular stones were found in the kidney: besides, the urinary bladder, that was hard, schirrous, an inch thick, and contracted, contained a stone that entirely filled its whole cavity. (e)

From all which cases it is sufficiently evident, that it is sometimes extremely difficult to form a just diagnosis of a stone in the bladder. All those symptoms are now to be considered in succession, that are usually observed in calculous patients, and therefore are to be reckoned diagnostic signs.

(c) *Acta Helvet*, Tom. i. pag. 17. etc. (d) *Baader Observat. Medic.* pag. 27, 28. (e) *Ibidem*, pag. 29, 30.

From the pain both before, in, and after making water.] Left a mistake happen in this diagnosis, prudent physicians and surgeons carefully attend to every symptom that has preceeded, as well as to those which they observe at that particular time. Whence they usually enquire, whether the patient has formerly shewn signs of a calculous predisposition; of which we have already treated at § 1414. They next examine, whether the signs of a renal stone, which have been laid down in the preceeding paragraph, have been observed before; whether such symptoms have appeared as usually accompany the stone, when passing from the kidneys through the ureters into the bladder; and which commonly soon cease when the stone has slipped into the cavity of the bladder; and whether, such signs having been observed, without the patient's voiding a stone, after some time a difficulty in making water has come on; which sometimes only happens after several months have elapsed, the stone being now grown large from its stay, or its surface rendered rough from the apposition of fresh calculous strata to the former nucleus.

While the stone continues small, we readily conceive, that it cannot greatly disorder the bladder, when it is lodged in its cavity: but where it is lodged in its neck that is narrower, it then becomes troublesome, and frequently creates exquisite pain, especially if it is angular, or rough.

Aretæus has excellently remarked this (f) *Sin haud ita magnus est calculus, frequentius lotium cohibetur: nam facile in cervicem delabens lotii transitum obstruit. Securius autem, quam grandiores, exciditur.* “ But if the stone is not so large, the “ urinary discharge is more frequently obstructed.

(f) De causis et signis Morbor. diuturn. cap. iv. pag. 54.

“ How.

“ However it is extracted by Lithotomy, with
 “ greater safety, than larger stones.” For stones
 when they are large, are not so easily nor so frequently forced into the orifice of the neck of the bladder. Now if a stone be fixed in this orifice by the first effort to discharge the urine, then before the urine is evacuated, a violent strangury and pain come on; if at first the urine be partly discharged, and afterwards the stone, propelled with the remaining stream of urine, be fixed in the neck of the bladder, then the same symptoms ensue in making water, and the urinary discharge is suddenly stopped, or is squeezed, with a violent strangury, drop by drop, between the stone and the neck of the bladder; if after the urine is evacuated, the sphincter of the contracted bladder be shut, unless by this effort such a small stone can be pushed back into the cavity of the bladder, this excruciating strangury continues a great while, and occasions exquisite pain even after the urine is evacuated.

But where the stone grown larger, cannot so easily be forced into the orifice of the bladder, the passage of the urine is not so easily obstructed; *sed neque dolorum, neque gravitatis expertes sunt, licet urinam expedite reddant* (g). “ But such
 “ persons are neither exempt from pains, nor a
 “ sense of weight, though they may discharge
 “ their urine freely. For it is a well known fact, that the bladder is chiefly contracted by its own contractile power, and propels the urine to a pretty great distance, so that from its contraction its cavity is gradually lessened, and at last scarce any cavity at all is left; for though when we have an inclination to make water, we can by a plentiful inspiration of air, and holding the breath,

overcome the resistance of the sphincter muscle of the bladder, yet as soon as the urine begins to flow through the urethra, there is no longer occasion for this effort; but the bladder proceeds to evacuate all the remaining urine by its own contractile power. Nay, if the urine either by its quantity or acrimony irritates the bladder, the urine is expelled with great force by the action of the bladder alone, even against our will, and in spite of our utmost endeavours to retain it in the bladder.

Now if a large stone be lodged in the bladder, the sides of the bladder, when it is contracted, are with great force pressed and rubbed against the hard stone, frequently with exquisite pain, although the stone should be smooth. What enormous tortures must therefore ensue, should the stone be rough and rugged, or beset all over with sharp points! Many such stones may be seen among the numerous collections that are preserved in hospitals, or in the cabinets of eminent lithotomists, which have been extracted from human bladders by lithotomy, or from dead bodies.

Whence Le Dran (*b*) a celebrated French surgeon has offered this diagnosis; when a small stone is lodged in the neck of the bladder, the pain ceases after the first drops of urine come away: when the stone in the bladder is large, the greatest pain is felt while the last drops are evacuated: but when the difficulty in urining depends on some disease of the coats of the bladder, the pain continues equal all the time of the evacuation.

However, if a small but sharp stone sticks in the neck of the bladder, it seems as if the pain must also last the whole time of making water,

(*b*) Observat. de Chirurgie, No. 80. Medical Essays, vol. xi. p. 378.

since the urine forces the sharp stone against the sides of the neck of the bladder, and thus occasions a continual sensation of pricking. I have sometimes known such little stones voided, after having caused most excruciating pain for several weeks.

If the stone is too large to enter the neck of the bladder, yet it will cause a partial suppression of urine if it lies against the orifice, especially if it has a smooth flat surface, as has been frequently observed. I saw in the corpse of a nobleman, such a stone in the bladder, of a middling size, transversely placed over the orifice of the bladder; whence the urine was squeezed out with vast difficulty and pain. This patient used obstinately to insist, that he laboured under an ulcer of the bladder, not the stone; nor would he ever suffer himself to be searched with a sound. Yet no ulceration was found in the bladder after his decease; but a stone alone had occasioned all these complaints.

When the stone has grown so large as to fill the whole cavity of the bladder, a most troublesome and painful sensation is perpetually felt, as if the urinary bladder was distended. I have already related such a case; namely, of a stone not only filling the whole bladder, but also, with its snout, as it were, stopping up the whole neck of the bladder. In this poor wretch the pain was continual.

[From the urine being discharged only by drops.] That is where the stone either from its situation prevents the discharge of the urine, or from its bulk hinders the contraction of the bladder. In such cases there is an almost constant strangury, sometimes attended with such excruciating anguish, that the patient loses his senses, and becomes raving

ing mad from the violence of the torture (i). Whence these poor wretches change the posture of the body every possible way, in hopes of ease; which they also sometimes obtain, when they are fortunate enough to move the stone in such a manner that the urine can be evacuated more freely; sometimes they stand on their heads, with their legs lifted upright, that the stone may be removed by its own weight from the mouth of the bladder (k). Celsus when treating of the signs of a stone in the bladder describes these accurately: (l) *Difficulter urina redditur, paulatimque, interdum etiam sine voluntate distillat, &c: eamque quidam promptius reëti, quidam resupinati, maximeque hi, qui grandes calculos habent, quidam etiam inclinati reddunt, colemque extendendo dolorem levant. Gravitatis quoque cujusdam in eadem parte sensus est, atque ea, cursu, omnique motu, augetur. Quidam etiam cum torquentur, pedes inter se, subinde mutatis vicibus, implicant. Fæminæ vero oras suorum naturalium manibus admotis scabere crebro coguntur. Nonnunquam, si digitum admovent ubi vesicæ cervicem is urget, calculum sentiunt.* “ The urine is made
 “ with difficulty, and comes away slowly and by
 “ drops, and sometimes involuntarily, &c: some
 “ make it more readily standing upright, others
 “ lying upon their back; especially those who
 “ have large stones; some also in an inclined posture, and others by drawing out the yard alleviate their pain. There is also a sensation of
 “ weight in that part, which is increased by running, and every kind of motion. Some also in
 “ the paroxysm of the pain cross their feet over
 “ one another, often changing them. But women are often obliged to rub the external ori-

(i) Denys Aanmerckingen over den Steen, c. 11. p. 41.

(k) Ibidem, p. 57. (l) Lib. 11. e. vii. p. 61.

“ fice of their private parts with their hands :
“ sometimes if they apply their finger to that
“ part, when it presses upon the neck of the
“ bladder, they feel the stone.”

’Tis true indeed, that this strangury, if considered separately, does not afford a certainty of a stone in the bladder; for it accompanies an inflammation of the bladder, and of the gut rectum; and sometimes happens after the application of cantharides, drinking of vapid beer, &c. but if other signs likewise concur, which give just reason to suspect a stone, this disagreeable and painful strangury, greatly confirms the diagnosis. Whether therefore hath Hippocrates (*m*) deduced the diagnosis of a tubercle situated in the bladder, and causing a difficulty in making water, from hence, that such patients are uneasy in every situation, but calculous patients are sometimes relieved from a change of posture; namely, if the position be such, that the stone cannot slip down towards the urinary passage.

White, with a mucous thick heavy sediment in great quantity.] This diagnostic sign is reckoned of great moment, and indeed with justice, for it is almost always present when a stone is contained in the bladder, and has remained there a considerable time; especially if the stone is large, so that the sides of the contracted bladder are rubbed against it. For where a small stone, newly passed from the kidney, was contained in the bladder, I do not remember ever to have seen this sediment in the urine: so small a stone could scarcely irritate the bladder, even when in its greatest state of contraction.

But where a large stone is lodged in the bladder, an incredible quantity of viscid glutinous

(*m*) Coacæ Pronatat. No. 472, 473. chart. tom. viii. p. 879.

matter is sometimes voided with the urine; but not intimately mixed with the urine, for at the very instant of its being discharged, it falls to the bottom of the chamber pot, a pale coloured stinking urine, floating over its surface; which bad smell the sediment also emits. If the floating urine be cautiously poured off, this sediment alone remains behind in the vessel; if the vessel be further tilted, this sediment will not run off in part, but the whole mass, cohering together, falls over the rim at once: it generally is of an ashen colour, and sometimes such a quantity of it is voided, as almost fills the chamberpot, as I saw in a person, who for several years had been afflicted with the stone, and in whose bladder, after his death, three stones were found.

Some indeed have judged this sediment to be pus, or what the surgeons term matter; but in the body of this man, the bladder was not found ulcerated; though he voided every day such a quantity of this glutinous substance with his urine. It is certain, that a stone, if rugged or angular, may so wound the bladder, as to cause an inflammation, and its consequence a suppuration, and true pus be voided with the urine: but by shaking the vessel, that purulent matter is mixed with the urine, and diluted; but this mucous viscid sediment will not mix with the urine; whence I am of opinion, that it is a different substance from pus.

It is well known, that every part through which the urine flows, or in which it is retained, is lined with a mucus, that prevents these parts from being irritated or injured by the acrimony of the urine. The pelvis of the kidneys, the ureters, the internal surface of the urinary bladder, and the urethra are smeared over with such a mucus. Moreover observations seem to teach, that in consequence

consequence of an inflammation of these parts, from what cause soever this may happen, the mucus is secreted both more viscid, and in greater quantity: thus after taking sharp diuretics, and after cantharides have been applied to the external surface of the body in a large quantity, a very troublesome strangury ensues; and in such cases instead of urine, I have seen a viscid mucus voided with great pain. Now when a large stone is lodged in the cavity of the bladder, it is constantly irritated; but most of all, if the stone be rugged or angular; and hence the great quantity of mucus, that calculous patients void with their urine, seems to be produced. For if that viscid sediment was true pus, the ulcer must be very large, to be capable of producing such a quantity of matter.

Besides, if by a successful operation the patient is freed from the stone, the viscid sediment in the urine ceases sooner, the cause of irritation being now removed, than it possibly could do, if it was furnished by an old large ulcer. For I have seen, on the fourteenth day after the operation, and sometimes still earlier, the urine come away clear without any such sediment.

Helmont (n) maintains the same opinion, where he is proving, that this mucus is not the cause, but the effect of the stone. *Sin autem, tam renes, quam vesica, juxta indolem quæque suam quid muccidum, praesente calculo, excernant, desine mirari, partem utique ab hoste obsessam, quidquam de suo alimento amittere continuo, ac velut plorare (oculi instar inimico pulvere obsessi) humorem alimentarium. Persentiunt quippe singula in nobis, quae consentanea, quæque perosa et exsecranda; ejusque sensationis*

(n) In capitulo Supplementorum Paradoxum numero criticum, p. 558. §. 32, 33, 34.

nec obscura quidem indicia ubique exprimunt. Alio-
qui namque, exciso calculo vesicæ, nondum cessaret
continua mucoris emanatio; si nempe mucus causæ,
et non effectus, calculorum rationem habere. “ But
 “ if the kidneys or bladder, each according to
 “ its own particular disposition, void any mucus,
 “ when a stone is lodged in either part, cease
 “ to wonder, that a part so invested with an ini-
 “ mical body should continually lose some part
 “ of its aliment, and as it were weep (like an
 “ eye irritated by dust) the nutritious humour.
 “ For every part of our body perceives what is
 “ agreeable to it, and what is disagreeable, and to
 “ be avoided; and indeed every where express
 “ clear signs of this sensation. For otherwise the
 “ stone being extracted from the bladder, the
 “ continual flux of mucus would not cease; if
 “ for example, the mucus was the cause, and not
 “ the effect of a stone.”

In another place (o) where in his usual manner
 he is inveighing against the schools of physic,
 he makes use of these words: *Non est ergo illa*
mucago materia calculi ex qua, sed lugubris hujus
effectus. Atque ideo malo istam mucilaginem in ma-
teriam calculi accusant. “ Thin mucus then is not
 “ the matter of which the stone is formed, but
 “ one of its lamentable effects. And therefore
 “ they unjustly accuse this mucus of being the
 “ original matter of the stone.”

He afterwards illustrates this matter by other
 instances: *Quod nimirum festuca in oculo continuas*
proritet invito lachrymas; os ethmoides, oppletum
mucos, continuum in coryza promoveat laticem, mu-
cumque profundat; angina quoque sic indefinentem
et mucidam salivam spumet; dysenteria proprium
stillet, cum sanguine, intestini mucum. Vidissent enim

(o) Idem de Lithiasi, cap. 11. § 4, & 5. pag. 664.

facile tum, a vesica sic per Dueleck (calculus) obsessa mucus fieri, et continuo promanare. Nonau tem, quod lachryma sit causa festucae in oculo, vel profusus latex aquosus os spongiosum in fronte oppilet, vel saliva mucosa anginam procreet etc: Etenim sic vesica continuum sui alimenti depravati plorat mucus, praesente calculo, cessatque illo absente. “ That
 “ to wit, a stye in the eye provokes con-
 “ tinual involuntary tears; the ethmoide bone
 “ filled with mucus, promotes a constant flux in
 “ a catarrh, and discharges its mucus; the quinsy
 “ also thus spues out a continual discharge of
 “ mucous saliva; the dysentery trickles down the
 “ proper mucus of the guts mixed with blood.
 “ For then they would readily have perceived,
 “ that this is the manner in which the mucus is
 “ formed and constantly discharged from the
 “ bladder irritated by a stone. Not indeed, that
 “ the tears are the cause of the stye in the
 “ eye, or a profuse aqueous spring in the fore-
 “ head loads the ethmoide bone, or the mucous
 “ saliva causes the quinsy, &c.: And also thus
 “ the bladder weeps without intermission the mu-
 “ cus of its depraved aliment, when a stone is
 “ contained therein, and when the stone has been
 “ extracted, the discharge ceases.”

That an irritation of the urinary passages alone is capable of producing a quantity of mucus, which is improperly called matter or pus, Goulard clearly proves in his treatise on the disorders of the urethra. This celebrated surgeon, noted for his remarkable success in curing these diseases, has merited the highest commendations, for having candidly communicated to the public the method and remedies which he had so successfully used. (p) He observes that the urethra, when

irritated, oozes out a mucus, not pus; and indeed in various quantities, according to the greater or less degree of irritation; however, in such sort, that if diseases of the urethra should stand in need of the more acrid remedies, then the vessels being contracted by a sharper stimulus, the flux of mucus is diminished, or entirely stops. He also observes, that the urethra is so sensible, that it oozes out a mucus from simple mechanical irritation, for instance, from a small stone lodged in the urethra, a leaden probe, a bougie prepared of soft wax, and other like substances.

These are the principal reasons that induce me to think, that this viscid sediment which is voided with the urine by persons troubled with the stone in the bladder, is not properly to be called pus, and therefore cannot be accounted a certain sign of an ulcerated bladder.

I must not dissemble, that very able Lithotomists are of a different opinion, and consider this viscid mucus as true pus. The eminent Lithotomist, here at Vienna, Palucci, (q) describing a successful operation, whereby he freed a man near forty years of age, from a large stone that weighed above four ounces, and whom I afterwards saw in perfect health, remarks, that this person had been afflicted with calculous complaints from his infancy, and had borne them courageously for many years, nay had performed frequent journeys in post chaises, and on horseback, though after riding he usually voided a great quantity of blood with his urine. Moreover for several years past he had voided a large quantity of white matter with his urine, but so viscid, that it would hardly separate from the bottom of the chamber-pot, when it was emptied; and had an

(q) Lettre de Palucci a Mr. de Hamelauer, pag. 15.

intolerable stinking smell : Whence he concludes, that there was a large ulcer in the bladder : he adds, that a similar viscid matter was also voided through the fundament : and the patient complained of an itching in the gut rectum, and a frequent tenesmus ; whence he judges, that not only the bladder, but the gut rectum also was ulcerated. Indeed, this conclusion would have been extremely rational, if that viscid matter had been true pus.

But does it seem credible, that this unhappy man could have supported so many years, under such an improper kind of life, a large ulcer in the bladder, that had also eroded the contiguous gut rectum ? Yet, at intervals the patient was chearful ! carefully concealing his disorder, lest it should come to the knowledge of others. Or might not this matter have found an easier passage into the cavity of the rectum, and been voided through the anus, from those violent strainings, with which he could squeeze out only a few drops of urine ? Or could such a large ulcer of the bladder, and of such long standing, have been so cleansed and consolidated within the space of forty days, that the whole urinary discharge should pass through the natural passage ? Truly it scarce seems probable.

Nor is it difficult to understand why a like viscid matter was voided through the gut rectum. The stone had a sharp protuberance which projected against the rectum. (r) The stone itself was placed in an oblique position, and one of its extremities resting upon the left side of the gut rectum, was immersed in a very deep hole, whence Palucci removed it with great dexterity, with a noise that was readily heard by

(r) Ibidem, pag. 88, 89.

the bye-standers, (s) and afterwards happily extracted it. Now it is well known, that the internal surface of the gut rectum, is beset with a great number of mucous glands, which prepare a mucus, and excrete it, always in a larger quantity, when the gut is irritated from any cause whatever ; whence, when a dysentery terminates in a painful tenesmus, nothing is squeezed out by those troublesome motions to go to stool, but mere mucus. Moreover, that the gut rectum is irritated by a stone lodged in the bladder, is evident from hence, that boys having the stone sometimes are afflicted with a constant tenesmus ; so that often a *prolapsus ani* ensues as I have frequently seen.

'Tis true indeed, that the wound not being wholly consolidated, though the urine had for several days passed the natural way, a few drops of matter oozed through a small fissure that still remained in the wound, and on the following day a very little of the alvine fœces ; whence it appeared that the gut rectum was perforated. (t) Notwithstanding, it is not clear from hence, that the intestine had been eroded by an ulcer of long standing. For the sharp protuberance of the stone was inclined towards the intestine as has been already mentioned, which might wound the gut. Besides on the fortieth day after Lithotomy, a clyster had been thrown up, of which the patient complained, that it had been injected in too great quantity, too hot, and with too much force : Twelve hours after, he was seized with a shivering fit, which lasted a considerable time, and was followed by a strong feverish paroxysm, and the following day a small quantity of matter issued from the wound. There have been in-

(s) Ibidem, pag. 24, 25. (t) Ibidem, pag. 105, 106.

stances, as I have remarked on another occasion, of the rectum's being perforated from the imprudent administration of a clyster.

From all these circumstances considered together, it may be concluded, that this perforation of the rectum, was not produced by the erosion of an old ulcer, but rather by a recent cause; which conclusion, the quick and successful cure, that was made without the least cutting, strongly confirms; which certainly could not have been expected in a fistulous ulcer of the fundament.

Besides, in this viscid mucus, which persons afflicted with the stone in the bladder usually void with the urine, other properties also are observed, which show that it is altogether different from pus or matter, properly so called. Beverwyck (*u*) has observed this viscid mucus in patients having the stone; which whenever discharged in great quantity with the urine, he always found in the dead body, the bladder fleshy and thickened, so that in the body of a child three years old, it would equal in thickness a man's little finger, in adults it was often a thumb's breadth thick; when other stone patients who voided thin limpid urine, had the bladder membranous, as it usually is in its natural state. Such thickened but soft bladders, I have sometimes seen in dead bodies, especially where the bladder contained a large stone. In such cases the size of all the constituent parts of the bladder seems to be increased, and as in the gravid uterus, the vessels that before could scarcely be seen, are enlarged to such a degree as to equal, nay exceed the size of a pen in diameter, so also the

(*u*) Beverwyck Steenstuck, cap. iv. pag. 53.

vessels of the bladder that serve for the secretion of its natural mucus, being increased in diameter, secrete in the bladder a much greater quantity of mucus.

In the bodies of all the calculous subjects, whose bladders I have found thus thickened, I have never discovered the least marks of an ulcer, and yet during their life time, these persons had voided great quantity of tenacious, extremely foetid mucus. And, the stone having been happily extracted by the operation, I have seen many perfectly cured; so that not the least sign of such mucus ever after appeared in the urine: whence it seems as if it might be concluded, that the bladder in these persons had entirely reassumed its natural state.

It has been already mentioned at § 1414, that the antient physicians attributed the origin of the stone to a pituitous humour hardened by heat. The illustrious Harvey, in his letters to Beverwyck (*w*), maintained this opinion of the antients, and confirmed it chiefly by this argument, that if this mucus, if exposed to the air, would be in a short time changed into stone. For a woman formed little balls of this mucus spontaneously dried in a dish, which afterwards being further dried became hard as stone. Beverwyck therefore kept for four years in an open glass vessel, some mucus of the same kind, collected from the urine of a youth who died of a large stone in his bladder, but found a powder like that of rotten wood, which had not the least appearance of hardness or solidity. He acknowledges however, that he afterwards, twice in the same week, spread this mucus of calculous persons upon a sheet of white paper, which in-

(*w*) Ibidem, pag. 59, 58.

deed soon grew hard, but yet might easily be rubbed between the fingers into a rough gritty powder.

Denys (x), searching a man with a sound, found that he laboured under a large stone in his bladder, and would have cut him for the same, had he not presently after died of another disease. This person used to lay this viscid sediment of the urine round a globe, dry it in the shade, and then cut it into pieces with a knife, that were hard as stone, which he kept in a box: and had collected such a quantity of mucus concreted by exsiccation, in no very long time, as would more than fill a man's hat. The celebrated De Haen (y) saw after the operation of Lithotomy, *gluten putridissimum, ad plicas angulosque vulneris adhærens, spatio nuchthemeri in veros abivisse lapillos; quemadmodum etiam collectum gluten in charta Emporetica in crassam abibat ac calcariam materiam.* “A very putrid glue adhering to the plaits and angles of the wound, that in the space of twenty-four hours formed real little stones; as also the same glue collected in filtering paper became a thick and calcarious substance.” Whence it again appears that this viscid sediment is different from pus. Moreover he found in the mucus of persons afflicted with the stone, always more or less of such a calcarious substance remain after exsiccation. Are the earthly particles abraded from our solids, mixed with this mucus, while washed by the urine, that contains such particles in its composition? Or whensoever a similar calcarious crust accretes round a stone already formed, is produced by the urine, or by this viscid mucus, in

(x) Aanmerkingen over den steen, cap. 1. pag. 37, 38. (y) Ratio Medendi, tom. vi. pag. 207, 208, 209.

both which the stone is immersed? Undoubtedly stones have been extracted from the bladder, whose outer circles were friable as lime, and crumbled to pieces, when grasped by the forceps.

Lithotomist shave observed (z), that the stones called calcarious, are of very quick growth. Denys oftentimes saw patients who had complained only four months of symptoms of the stone in the bladder, and yet upon searching them with a sound, found a pretty large stone, which, lithotomy being deferred for some particular reason, when extracted appeared to have grown much larger since the time of his searching the bladder; but very friable and of a calcarious nature. A great quantity of this viscid mucus, replete with calcarious matter, which is voided with the urine of calculous patients, may lessen the apposition of such matter to the stone: but if a lesser quantity of this viscid mucus is secreted, or if it contains a smaller proportion of calcarious matter, a greater quantity may accrete to the stone, and its size be quickly increased. On the other hand the same celebrated Lithotomist has observed, a stone that he had discovered by searching the bladder, very little enlarged in bulk, after having remained therein four or five years: But in this case, the stone extracted by lithotomy, was hard, compact, and heavy.

The celebrated Hales judged (a) that nature by lining the places, through which the urine passes, or in which it is retained, with mucus, indicates the use of emollient and mucilaginous remedies, to prevent the growth of the stone.

(z) Denys Aanmerkingen over den steen, c. vi. p. 93, 94.

(a) Haemastatics on the animal calculus, pag. 220, etc.

Indeed,

Indeed, the internal surface of the bladder is by this means defended against the acrimony of the urine, and perhaps the incrustation thereof by calculous matter prevented.

Perhaps also it may sometimes prove serviceable, by absorbing part of the calculous matter, which thus might pass out of the body with this viscid substance. May not sometimes this same viscosity, together with the calculous matter it contains, enter the substance of the stone, adhere thereto, and thus increase its size? Undoubtedly this mucus constantly washes the stone when lodged in the bladder. Hales macerated human stones in warm water (*b*), and found their surfaces covered over with a white mucus. It has been mentioned before at § 1414, that Stack has observed, that a glutinous matter is contained even in flints, and in animal stones, and indeed in still greater quantity in the last: he adds, that this glutinous matter is elastic: and that in his opinion, every thing capable of restoring the air, confined in this elastic matter, to a state of activity, is a dissolvent of the stone.

Hence many circumstances still remain to be investigated by careful observations, concerning the natural properties of the urine, and this viscid matter voided with the urine by persons labouring under the stone in the bladder. For instance, whether may not only this mucus, but also the urine, contain such calcarious matter? What properties does this calcarious matter possess? Or what species of stones does this same calcarious matter accompany in preference to the rest? etc.

That the urine sometimes contains a great quantity of such, or at least of a similar matter, we

(*b*) Ibid. pag. 216.

learn from an extraordinary case, communicated to me by the deceased Bose, formerly professor in the university of Wirtemberg, in a letter dated the 15th day of October, 1747. It seems he communicated it also to the celebrated Reaumur, who has inserted the identical case in the memoirs of the Royal academy of sciences. (c) A man about fifty-six years of age, in other respects healthy, began to be tormented with slight fits of the gout, that returned at intervals. At the same time he became so impatient of cold, that he was obliged to have his bed warmed even in the midst of summer. He of a sudden began to make urine like milk; which when it had stood about an hour became limpid, a whitish sediment being deposited at the bottom of the vessel, a quarter of an inch thick. This sediment at first was of the consistence of tempered clay, and might be cut like soap; but in an hour or two acquired the hardness of chalk or plaister. He constantly made this sort of urine for eight or nine months together, without finding the least inconvenience from it. This person was of opinion, that he had voided sixty or seventy pounds weight of such matter, a quantity sufficient to have formed a statue of him, made of stone the production of his own body. At the expiration of the above time, he happened to remove to another house; and from the first night he laid in his new dwelling, this flux of urine resembling milk ceased, and never more returned. Notwithstanding, he found no difference with regard to his health, either for the better or for the worse, though this cretaceous matter so suddenly ceased being evacuated from the body.

(c) Memoires de l'ademie Royale, etc. 1747. pag. 56.

In the letter sent to me I find, that this new house was situated at no great distance from his former place of residence.

By an itching at the head of the yard.] Sometimes also a pain is felt there; but an itching more frequently, and often a very troublesome one. Aretaeus says (*d*), treating of calculous patients, *quod istis virilia saepius arrigantur: quando enim mejunt, subestque calculus, tractant, attrahuntque, pudenda, tanquam calculum cum vesica exemturi.* “ They are subject to frequent erections of the
“ penis: for when they make water, they handle
“ and draw out the privy member, as if they
“ were about to tear out the stone with the bladder.”

Moreover in the female sex, Celsus (*e*), among signs of the stone enumerates the following: *Fæminae oras naturalium suorum manibus admotis scabere crebro coguntur. Nonnunquam, si digitum admoverint, ubi vesicae cervicem is urget, calculum sentiunt.* “ Women are often obliged to rub the
“ external orifice of their pudenda with their
“ hands: sometimes if they apply their finger to
“ that part, when it presses upon the neck of
“ the bladder, they feel the stone.” The internal membrane of the bladder, as it were prolonged, seems to invest the urethra; and the same reflected about the end of the urethra, covers the nut of the yard; which is a continuation of the fungous body surrounding the urethra: hence it does not seem strange, that the head of the yard should be affected, when the interior surface of the bladder is irritated by a stone. Nay it has been observed, as already has been said, that the head of the yard is sometimes full of pain, when a stone passing

(*d*) De causis et signis morbor. diuturn. Lib. 11. cap. iv. pag. 55. (*e*) Lib. 11. cap. vii. pag. 61.

from the kidneys irritates one of the ureters. Denys (*f*) observed a similar very troublesome itching of the glans penis from this cause; which continued two or three days, after the expulsion of a small stone, or nephritic gravel, along with the urine. A like kind of itching accompanies the stone in the bladder, and sometimes an elongation of the yard drawn out by the fingers, gives ease, and a more ready exit to the urine. Which relief the unhappy persons afflicted with the stone having once experienced, perpetually extend the yard, and rub it with their hands; whence sometimes its bulk is so enlarged in boys, as to exceed that of a grown person's, and the vessels become varicous; he sometimes, from the constant friction, saw the yard inflamed, and the skin of the fingers flaccid and pale, by being continually macerated in, and wetted with the urine trickling down drop by drop. He also saw the fingers in a calculous patient contracted, from his squeezing the yard night and day. Sometimes they become so accustomed to this habit, that when freed from the stone by the operation of lithotomy, they can hardly abstain from perpetually squeezing their private parts.

By a Tenesmus in making water.] This symptom is frequently met with in calculous patients; especially if they have a large stone in the bladder: for when they endeavour by straining to squeeze out the urine, they press the stone towards the neck of the bladder; and then the gut rectum is compressed and irritated, whence ensues a tenesmus; but more frequently in young than old persons: sometimes these inclinations to go to stool are so frequent and violent, that they cause a bearing down of the fundament (*g*). Denys from

(*f*) Aanmerkingen over den steen. cap. 1. pag. 43, 51.

(*g*) Ibid. cap. 1. pag. 59.

a like cause, saw the gut rectum hang down six fingers breadth from the anus; which sometimes cannot be reduced without much difficulty. Aretæus has recorded this very well (*b*). *Anus quoque vitii particeps redditur, pruritu laborans. Prominet vero et intestinum rectum, vi, contentionibus, imaginatione, perinde ac si lapis excernatur: ambo enim inter se copulantur anus et vesica, quorum uno affecto, et alterum afficiatur necesse est: propterea inflammato podice urinæ exitus clauditur, et vesica exacerbata sedes non dejicit, licet alvus admodum sicca non sit.*

“ The fundament also shares the disorder, and is
 “ affected with an itching. The gut rectum is
 “ also forced down by the violent strainings, in
 “ like manner as if a stone was then voiding:
 “ for the fundament and bladder are connected
 “ with each other, one of which being affected,
 “ the other also is necessarily affected: therefore
 “ in an inflammation of the fundament, a sup-
 “ pression of urine happens, and when the bladder
 “ is disordered, the patient also labours under cos-
 “ tiveness, though the body be not then naturally
 “ very costive.” For this tenesmus, excited by
 a stone in the bladder, is frequently in vain, and
 continues to be troublesome, though the gut rectum
 be entirely emptied of the alvine fæces.

By a finger introduced into the fundament.] For
 as in the male sex, nothing is interposed between
 the stone and the finger introduced into the gut
 rectum, except the coats of the gut and the blad-
 der, the stone may easily be felt, if it is of any
 size; for it slips of its own accord towards the
 neck of the bladder, that lies upon the gut rec-
 tum. But the intestine ought previously to be

(*b*) De causis et signis morborum diuturn. lib. 11. cap. iv.
 pag. 55.

cleared of the alvine fæces, by means of a clyster; the finger is then to be introduced with its back part turned towards the *os coccygis*; for thus the point of the finger may commodiously be bent forwards towards the *os pubis*, in order to feel the stone. But where the bladder is thickened, as is often the case in persons afflicted with the stone, or the gut rectum thickened and indurated from frequent bearings down, it is readily conceived, that it must be more difficult to feel a stone in the bladder; also, if thick varicous veins are spread over the sides of the rectum, as is self-apparent. In women, the stone is searched for, by introducing a finger into the vagina, and in like manner bending it towards the bones of the pubes.

Not only the fore finger, but the middle finger also may be introduced into the anus together with the former, as will be hereafter shewn, where we describe the different methods of cutting for the stone. But the fingers are previously to be anointed with oil, and the nails cut, to prevent their injuring the part. Denys has observed (*i*), that calculous patients, when labouring under a suppression of urine, try to remove the stone from the neck of the bladder, by introducing a finger up the fundament: but cannot succeed, unless when lying on their back in a supine posture, with the heels raised higher than the head. Thus it sometimes happens, that they can form a pretty right judgment of the size of the stone, which is lodged in their bladder.

By the catheter.] Which for the male sex must be incurvated; while a straight one suffices for females, whose urethra runs straight, and is shorter

(i) Aanmerkingen over densteen, cap. 1. page 59.

than

than in males; whence also in them the catheter can be introduced with far greater facility.

This examination by the help of the catheter, requires a careful, wary, and experienced hand. Denys acknowledges (*k*), that he could not clearly describe by words the method of introducing the catheter into the bladder. An accurate knowledge of the parts, and frequent use, together with great caution, are required for any one to attempt this safely. If any obstacle occurs, no force must ever be used, but the operator is to change the catheter, for one thicker or thinner, or more or less incurvated, till the instrument is safely introduced into the cavity of the bladder.

The use of the catheter, as every body knows, is to draw off the urine, when it cannot spontaneously be evacuated, to inject medicines into the cavity of the bladder, and especially, to search whether or not, a stone be contained in the bladder; of which matter we are at present treating. Where the existence of a stone is clear, moreover by means of the catheter, its size, the ruggedness or smoothness of its surface, its shape, whether obtuse or angular, its mobility or immobility, as also its greater or lesser degree of hardness, may in general be ascertained.

Nevertheless, the most able Lithotomists have attested, that the investigation of the qualities, and number of the stones, when there are several, by the introduction of the catheter, is not always an easy task, a probable conjecture only can be formed on these heads. Besides, can the state of the bladder containing a stone be discovered by the catheter; whether it be large and expanded, or vastly contracted and indurated, schirrous, cartilaginous, lined with calculous concretions, or

(i) Ibid. cap. vii. page 112.

not? Whether beset round with fungous excrescences, or not? etc. For all these circumstances have sometimes been observed in human bladders, as will hereafter be clearly shewn.

Prudent and able Lithotomists carefully inquire into all these matters, before they determine to cut the patient; and likewise, from all these circumstances rightly weighed, form a judgment of the good or bad event of the operation. For though Lithotomy is never absolutely free from danger, yet this danger will be greater or less, in proportion to the size of the stone, and state of the bladder itself. I have known the operation attempted, where the stone was so large that it wholly filled the cavity of the bladder. The wound indeed was cured, and the unhappy patient survived the operation some months; however it would have been better not to have risked an operation, that could not possibly succeed. No prudent person will certainly undertake Lithotomy, where, upon searching, he has found the bladder extremely contracted, and of a cartilaginous hardness.

Above every other consideration, the prudent Lithotomist will determine nothing, but what he is absolutely sure of. If he should have plainly felt the stone, and by slightly striking it with the catheter, has perceived the sound of a resisting hard body, he cannot form any other judgment, than that a stone is contained in the bladder; notwithstanding he will not readily blame another, who previously, or afterwards, may search the same patient, yet cannot find a stone. For in this matter extraordinary circumstances sometimes happen, which are capable of deceiving even the most able and experienced surgeons.

(1) Marcell. Donat. de Medic. Hist. Mirab. lib. iv. cap. 30. page 236.

I knew an old Lithotomist, who candidly acknowledged, that his own mistakes had rendered him cautious. This person, upon searching for the stone, if he could not feel the stone with the catheter, never pronounced, that there was not a stone; but simply affirmed, that he had not found a stone.

(*l*) A nobleman had all the symptoms of a stone in the bladder: yet several able surgeons, in consequence of having searched his bladder with the catheter, unanimously declared, that they could not perceive any stone. The patient went to Padua, in order to be cut by Fallopius: (whose skill in medicine and anatomy every body is acquainted with) he, from all the different symptoms, concluded, that there was a stone in the bladder; but upon searching with the catheter, could not feel the stone any more than the other surgeons. *Quare, negotio infecto, Mantuam reversus, post multos longosque cruciatus e vivis discessit; dissecto cadavere, lapis insignis magnitudinis in vesica inventus, undique tamen humore multo ac crasso circumvestitus, instar anguillæ pellis involucro circumambiente.* “Wherefore, without undergoing the operation, he returned to Mantua, and after having long lingered under the most excruciating tortures, departed from this life; his body being opened after his decease, a stone of remarkable size was found in the bladder, covered all over with a great quantity of thick mucus, and inclosed in a membrane resembling the skin of an eel.” More instances of stones in the bladder, covered with membranes, nay and included in membranous cysts, are to be found in medical collections (*m*).

(*l*) Marcell. Donat. de Medic. Hist. Mirab. lib. iv. cap. xxx. pag. 236. (*m*) Academ. Royale de Chirurgie, tom. 1. page 395.

It is obvious, that from hence, great difficulty must arise in searching for a stone by the catheter.

In some cases it happens, that the sides of the bladder elongated into a bag, contain the stone, which sometimes slipping into the cavity of the bladder, can readily be felt with a catheter, but at other times cannot be perceived, being again received into the expanded protuberance of the bladder, moved from its place through the violent strainings of the patient, contortions of the body, etc. Does not the bladder extended into such a process, passing through the ring of the abdominal muscles, form what is termed a rupture of the bladder? It is not strange therefore, that from a retention of urine of long continuance, a frequent symptom in persons afflicted with the stone, such prolongations of the bladder may be formed, that are capable of containing not only a single, but even several stones.

An extraordinary case is related (*n*) of a youth about twenty, who came to Leyden with an intention to be cut for the stone. He had every symptom of a stone in the bladder: a large hard stone was readily felt with the catheter, not only by the very experienced Lithotomist Denys, but also by the celebrated Oosterdyk Schacht, who at that time publicly taught physic in the above university. The stone was so obvious, that it might also be felt in the perinæum, which appeared protuberant from the largeness of the stone. As the patient was tired, and disordered from his journey, the operation of course was obliged to be deferred for a few days; afterwards, on the day fixed for the operation, the patient being placed on the table, told the Lithotomist the

(*n*) Denys Aaanmerkingen over den steen, cap. iv. pages 73, 74.

operation would not then succeed; for the stone was gone away. It was imagined, that the patient terrified at the approaching operation feigned this excuse. But upon introducing the staff into the bladder, neither Denys nor the celebrated Oosterdyk Schacht who was present, could feel the stone. They ordered the patient to rise up from the table, and to walk about the house with the staff in his bladder, in hopes that by the motion of the body, the stone would return into the cavity of the bladder. But all was to no purpose, though they tried every thing they could devise. Denys therefore prudently deferred the operation. The patient said, that the preceeding day in the evening, he had felt the stone slip backwards toward the gut rectum: he affirmed that the same thing had divers times happened to him before, and the stone had thus lain concealed two or three weeks together; and that at such times he used to be tolerably well. The patient staid some weeks at Leyden, but the stone not returning into the bladder for a long time, at last returned home. The event of this case afterwards is not known.

The celebrated Dutch lithotomist in time past Gomar Van Bortel, (*o*) two hours before the operation, felt a stone with a catheter, nay when he introduced a grooved staff, to make the incision upon, he also plainly felt the stone: the incision having been made, the urine was discharged through the wound, yet this skilful lithotomist could not find the stone, notwithstanding he tried every means. The wound was soon perfectly healed. But as all the complaints of the stone still continued, the same lithotomist a year after, repeated the operation, and instantly caught a large stone between the

(*o*) Ibidem, cap. vii. p. 115.

blades of the forceps, which he happily extracted, and effected a perfect cure.

Denys taught by these, and many other similar instances, made it a constant rule, (*p*) that although before hand he was quite certain there was a stone in the bladder, from his having searched and found it with the catheter, yet he would never perform the operation unless he could at that very moment feel the stone: for he justly was apprehensive of injuring the patient, by searching the bladder a long while with the forceps, and of hurting his own character, if after such torture, he should be obliged to leave the stone unextracted. I remember an accident of this kind that happened to a Dutch merchant, who came to Leyden, on purpose to be cut by the celebrated Rau. Upon introducing the catheter, he plainly felt the stone, but as the patient, from his pains, and the fatigue of the journey, was feeble and exhausted, he endeavoured to recruit his strength and spirits, by a mild nutritive diet, for three weeks. At the expiration of which time the patient being somewhat recruited, a day was fixed for the operation. But then the stone could by no means whatever be found, and though the patient courageously pressed him to perform the operation, he absolutely refused. The patient lived three months longer, and though during the time he had frequently searched the bladder, the same uncertainty remained. After his decease, the stone was found in a hole, like a sausage, formed by the bladder, in its superior part, extended towards the left side.

It has been mentioned before, that renal stones passing through the ureters, more especially meet with obstruction in that part, where the ureter opens into the bladder. Sometimes such stones

(*p*) Ibid. p. 114.

lodge there, increase in size, and do not pass into the cavity of the bladder; whence they cannot be discovered by the catheter; as they may lie between the coats of the bladder; and so the catheter, striking against the stone covered with a membrane, emits no sound; which circumstance however is deservedly reckoned one of the principal signs of a stone in the bladder. The celebrated Littre (*q*) found such stones in the body of a youth twenty years of age; and justly observes, that the diagnosis of such stones is difficult, and the cure still more so. But he remarks, that they may be discovered more readily, by introducing a finger into the fundament; as the ureters are inserted into the bladder at no great distance from its neck, which lies upon the gut rectum.

Sometimes the extremity of such a stone reaches into the cavity of the bladder, whilst the remaining part is lodged between the coats of the bladder. In such cases, the catheter passed into the bladder, may touch an hard stone, the sound of the instrument struck against a stone may be heard, and yet if the operation is performed, it will be found extremely difficult to extract the stone. Such a prominent sharp point, when laid hold of by the forceps, is easily broke off; while the remaining part of the stone continues in its pristine seat, and is covered with the coats of the bladder; which, if laid hold of together with the stone, are lacerated with exquisite pain, an inflammation of the bladder ensues, and often death very speedily. The commentaries of a man of consummate abilities in his profession on such stones, deserve an attentive perusal (*r*). If the membranes that contain the stone can be cut through, such stones may

(*q*) *Memoirs de l'Academie des Sciences*, 1702, p. 34, &c.

(*r*) *Academie Royale de Chirurgie*, vol. i. p. 395, &c.

be extracted. But there cannot be the least doubt of the vast difficulty of this matter. However the famous Garengéot succeeded in such a case (s). If this cannot possibly be done, and it appears after the incision has been made into the bladder, that the stone adheres between the membranes of the bladder, the only hope remaining, seems to consist in its separation through suppuration, the wound mean while being kept open. By this method the celebrated Le Dran extracted such a stone, six weeks after the operation had been performed, and the patient was perfectly cured (t).

The principal signs of such a stone seem to be these; the urine flows pretty freely, as the neck of the bladder cannot be stopped up, or much disturbed; the stone appears immovable, and not very large; the point of the catheter as it were fixes itself upon the stone; the catheter being passed further into the bladder, the stone can no longer be felt; the bladder is generally capacious.

May not the passage in Aretæus be referred to this head, (u) where he says: *Quod si vesicae concreverit calculus ex curationibus patet.* (ξύμπεσόν) *Sed neque dolorum, neque gravitatis, expertes sunt, licet sint sine urinae difficultate.* “Whereas if the stone should grow to the bladder it appears from the cure. But such are neither free from pain, nor a sense of weight, though they do not labour under a difficulty in making water.” In the version it is read, *ex colliquationibus*; but in the text the word is μέλυσάμενοι, which does not seem to signify meltings down.

(s) Ibidem. p. 410.

(t) Ibidem, p. 418.

(u) De

causis et signis Morb. Diuturn, cap. iv. p. 54.

S E C T. MCCCCXXIV.

THE stone in the kidneys requires its being lessened, expelled from thence, and its being reduced to such a state, as not to do mischief.

The present subject is, how a physician ought to succour his patients afflicted with the stone in the kidneys. In the preceeding paragraphs 1416 and 1422, we have treated of those disorders that usually accompany or succeed a stone in the kidneys, several of which depend upon the size of the stone increased by degrees; whence the same, if the size of the stone can be lessened, may be alleviated; and therefore the diminution of the stone is deservedly reckoned one of the curative indications; which likewise affords hopes of an easier expulsion; which a larger bulk of the stone always renders difficult; as it must pass from the wider pelvis through the narrower ureter, in order to descend into the bladder, and afterwards be expelled with the urine out of the body. Now the expulsion alone of a renal stone effects a perfect cure, as otherwise there is always danger, lest the remains of the stone however much diminished, should again begin to increase, and all the evils, that for a time were abated, be renewed.

But medical history sufficiently evinces, that it is not always in the power of the physician, to lessen the bulk of the stone, and expel it when lessened. And then nothing else remains but to alleviate or remove the symptoms, that are usually produced by a stone lodged in the kidneys: this is what is meant by reducing it to such a state as not to do mischief.

That

That the hopes of effecting this are not wholly vain, is evident from hence, that sometimes after death stones have been found in the kidneys, though in the person's life time there never was the least suspicion of this disorder. Baglivi relates such cases, as has been already mentioned in § 1422 (w). A man twenty eight years of age, for ten months had laboured under a pain in his breast, that occasioned a difficulty of breathing, a vomiting that returned at intervals, and a sense of weight in his belly; after his decease, manifest causes of these symptoms were discovered. However, he had never voided sand or gravel in his urine, had never complained of any nephritic pains, and had never been attacked with a suppression of urine. Nevertheless the right kidney very large, and so cartilaginous that it could scarcely be cut through, contained a stone of six ounces weight, that consisted of concentric lamina, filled the whole cavity of the pelvis, and its inferior extremity protruded into the ureter, branched out into an irregular form: the whole substance of this stone was an heap of nephritic sand contained in a bony shell, in colour resembling white coral. The whole substance of the left kidney was wasted away; and in its place were little hydatids, filled with an acrid fluid (x). Eustachius saw an oblong renal stone, perforated in the middle, (y) which hence did not prevent the free descent of the urine into the bladder. *Hunc calculo minime laborare, constanter affirmabant medici; quia neque urina suppressa unquam fuerat, neque tenuis, aut turbida, seu sabulosa apparuerat.* "His physicians positively affirmed, that this person had not the stone; because he never had been afflicted with a sup-

(w) Opera Omnia, p. 118. (x) Academie des Sciences, 730, p. 35. (y) De renibus, cap. xlv. p. 122.

“pression of urine, nor had the urine ever appeared thin and pale coloured, turbid, or full of gravelly particles.” The methods to be taken, to obtain these three curative indications, are to be separately considered.

S E C T. MCCCCXXV.

THIS is effected, by keeping the patient to a liquid, soft, thin, and moderately salt diet; the drinking of water, or some similar fluid; and yet keeping up the vital powers.

We here treat of those things, from which a diminution of the stone lodged in the kidneys, may be expected. It has, in the preceeding part of this work, been proved from many circumstances, that the stone increases, while fresh elementary calculous principles are applied thereto, from the urine secreted in the kidneys. If therefore by any means whatever, the ready separation of those elementary particles of the stone from the urine, gliding over the stone, could be prevented, the stone would not be encreased in size, and there would be some hopes, that the surface of the stone might by degrees be abraded by the urine trickling down from the kidneys, and thus its bulk be lessened according to the old adage.

“Water hollows stones, not by its force, but from its frequent falling drop by drop.”

This diminution of the stone indeed would be very slow; but even hence great benefit would ensue, if the increase of a renal stone could be prevented.

It has already been mentioned at § 1419, that the matter of the stone more readily separates from the urine, and perhaps in greater quantity, in proportion to the tendency of the urine to putridity; and hence *cæteris paribus*, the stone in the bladder grows faster than when lodged in the kidney. Nay Hales judged, as was then likewise mentioned, that the stone grew quickest in the summer season; because at that time the urine usually is higher coloured, more acrid, and has a greater tendency towards putridity. Whence also as has been remarked at § 1414, the celebrated Lobb (z) directs: “that persons violently afflicted with the
“gout and stone, should wholly abstain from ani-
“mal food.”

But those who have perfectly recovered from these diseases, he allows to return by degrees to animal food; but at the same time advises them to use, both at dinner and supper, vinegar, and lemon or orange juice for sauce, and fruit, “to
“prevent the accumulation of animal alkaline
“salts beyond the limits of health.”

Whence the reason is apparent, why liquid, thin, soft food is recommended for patients labouring under the stone in the kidney. In Boerhaave's *Materia Medica* at this number, the principal things are enumerated, that may be used in diet to answer this intention. But, whether, through such a diet the urine may be so changed as not only not to enlarge the bulk of the stone, but rather to lessen it by its solvent virtue, will be considered hereafter at § 1428, where we shall treat of lithontriptics.

Moderately salt.] Helmont was surprized (a) that physicians forbade patients afflicted with the

(z) Lobb on the Gout and Stone, p. 127.
thiafi, cap. 111. § 18. p. 671.

(a) De Li-

stone, to use salt, for which prohibition however they could give no reason. He says a plentiful use of sea salt never hurts a stone patient; and that he knew this from experience. *Quin potius accurate notavit plures, qui copioso salis usu sibi calculi recentis et succrescentis recidivam amputaverint.* “ But rather he has accurately observed many, “ who by a plentiful use of salt have prevented “ the further growth of a recent and increasing “ stone.” In another place (*b*) he commends the use of spirit of sea salt taken in white wine. For this remedy not only removes, *senum mortales strangurias: verum insuper, quibus decidens justo major calculus e rene per aliquot menses in vesica moratus erat, tandem minutus, et megendo excretus fuerat; quem tamen antea, multoties repetito introitu in collum vesicae, toties per cathetera repelli retrorsum necesse fuerat.* “ The mortal stranguries of old “ people; but moreover in persons in whom a “ stone larger than the common size passing from “ the kidney had been lodged some months in “ the bladder, the stone at length had been diminished in size, and voided with the urine, which “ notwithstanding before, having repeatedly entered the neck of the bladder, had as often “ been obliged to be pushed back with a catheter.” Moreover the experiments of Stack, (*c*) which will be considered at § 1428, seem to confirm the opinion of Helmont: for when from his excellent experiments he deduces useful corollaries, he lays it down as certain, that every thing capable of restoring the air, lying concealed in the stone, to its former active state, is a dissolvent of the stone; moreover he observes that saline aqueous menstrua are most suitable in the beginning to the harder stones.

(*b*) Ibid. cap. vii. § xxviii. p. 702.(*c*) p. 33.

By the drinking of water or some similar liquor.] It has already been said, at § 1423, that in human stones and those of animals, nay even in the very flints, there is contained a glutinous substance that dissolves in water. This matter extracted, the cohesion of the other constituent parts of the stone with each other is lessened; whence they split asunder; nay, and if left in water for several days together, would be dissolved in different periods of time, according to the different degrees of hardness of the stones: moreover the celebrated Hales has observed (*d*) that stones dissolve much sooner in hot than in cold water; but while the solution is taking place, the stones are covered over with a whitish mucus.

If therefore water, or any thin aqueous liquid is drank in large quantities, such a maceration of the renal stone is caused, while it is wetted with a thin, warm, aqueous urine constantly trickling down upon its surface. Besides at § 1414, it has been demonstrated by many proofs, that the cloud which is collected in the urine of the most healthy person, voided after a tranquil sleep, contains in it the rudiments of the stone. But if the same urine, fresh made, is diluted with three times as much water, this cloud is either not formed at all, or at least much more slowly; whence the increase of the stone is prevented by drinking plentifully of thin aqueous liquors; while also there is at least some hopes of the stone's being dissolved; which are the greater in proportion as the urine is more diluted. For Hales observed (*e*) that the solution of a stone in hot water went on less successfully, when he added only a fortieth part of urine to thirty nine parts of water.

(*d*) Hæmastatics on the Animal Calculus, exp. viii. p. 216.

&c. (*e*) Ibidem

Baglivi recites the secret related in the consultations of Zecchius; *nempe, haustus aquae calidae ad libram circiter, statim ante prandium factus. Piso et Alexander multis ante Zecchium annis hoc idem aquae calidae remedium comprobarunt; dicentes, quod, post primum excretum calculum, nunquam in posterum alios genitos fuisse viderint, usum hunc aquae calidae multum continuantibus.* “To wit, a draught of warm
 “water, about the quantity of a pint, drank
 “immediately before dinner. Piso and Alexander
 “had recommended this same remedy of
 “warm water, many years before Zecchius; as-
 “serting, that after the first stone voided, they
 “had never seen any others, in future, generated
 “in persons who continued this method of drink-
 “ing warm water plentifully.” Now a greater quantity of warm water is easily borne by an healthy constitution; whence many have prescribed it several times a day, with no contemptible success (*f*).

The plentiful use of whey made of the milk of animals fed on grass alone, is preferred to the milk of others, in which besides a great quantity of water, the solvent virtue of grass is contained; the notable effects of which have been already mentioned in the chapter on the Hepatitis, and various kinds of Jaundice. For it appears, that calculous concretions in the gall bladder and biliary ducts, have been happily removed by the use of grass, and grass whey. Sydenham for his supper drank plentifully of small beer, to alleviate the symptoms of the stone in the kidneys with which he was afflicted, as has before been advised in the chapter on the Gout.

That the solid parts of the human body are relaxed by aqueous liquors, especially drank warm,

cannot be denied; and particularly the kidneys, as through them plenty of aqueous urine continually flows. Some authors have enumerated among the causes of a fit of the stone in the kidney, the too great laxity of the kidneys: apprehensive that thicker fluids than natural, would pass through the relaxed renal tubuli, which might afford the basis of a stone if they remained long in the pelvis or its branches. But the perpetual and more copious stream of thin aqueous urine than usual, must readily cleanse away whatever might begin to lodge there: whence there seems but little to be feared from this cause.

But many have dreaded a general weakness of the body debilitated by such a soft diet, and the plentiful drinking of aqueous liquors; nor without reason. But this evil is trifling, if compared with the tortures of a renal stone; nor is it very hard to be removed afterwards. Nay the langour that ensues from the long continued use of these, is considered as a good omen by Boerhaave, who in his *Materia Medica*, at this number gives us the following instructions: *Plurimum valet usus horum, tamdiu continuatus, donec alvus fit, manetque aliquamdiu, laxa; licet debilitas quaedam inde successerit: haec quippe felix solvit saepe vel inveteratum malum.* “The use of these continued until the
 “ body becomes soluble, and continues in a laxa-
 “ tive state a good while, is of great service;
 “ though some debility should hence ensue: for
 “ this favourable symptom often resolves even
 “ an inveterate disorder.”

By the vital powers.] For if these should be strong, the copious drinking of waters and aqueous liquors will be more easily borne: if less so, there would be reason to apprehend that the water copiously thrown in, might stagnate, be collected in the cavities of the body, and so produce

duce the dropfy ; as was proved at § 1229, where we treated of the causes of the dropfy.

S E C T. MCCCCXXVI.

THE second is obtained by relaxing the vessels with baths, clysters, and oleaginous liniments ; by lubricating the passages with emollient, soft, and mild oleaginous medicines ; by opening them with opiates and anodynes ; by prudently forcing the stone forward with gentle diuretics, and by gentle motion.

A renal stone, that it may be expelled from the body, must pass through one of the ureters which are much narrower than the pelvis of the kidney : whence if a renal stone should have already acquired such a bulk that it cannot freely pass through the ureter, it will stick in its way, and distend and irritate the ureter, which being very sensible, will be contracted, as has been said at § 1416, and thus the obstacle to the descent of the stone be augmented. Now what remedies are required to mollify and relax solid fibres, too resisting and rigid, we have already shewn at §. 35 and 54. In the *Materia Medica*, at this number, such prescriptions are contained, composed of emollient remedies, after the manner of which other similar ones may be prepared. But these are applied in every way, both externally and internally, that the patient thereby may the more certainly and quickly obtain relief.

Baths prepared of these, in which the patient may sit, the water reaching up as high as the loins, usually called *Semicupia*, are of vast service ; after these baths the region of the kidneys
and

and ureters may be rubbed with relaxant liniments; fomentations of the same kind may be applied, and the most emollient decoctions are injected by way of clyster, that the gut colon, filled with these, which lies near the kidneys, may comfort them with a permanent fomentation: soft oils are usually mixed with these clysters, and exhibited mixed in broths, that all the parts may be rendered as slippery and moist, as art can possibly make them. Thus likewise the spasmodic contraction of the ureters, from the irritation of the stone, is removed, by the same remedies which Helmont judged the principal cause of a nephritic fit, as has been said at §. 1417.

In another place he adds the following words: (g) *Quoniam juvant praefata humectantia, althea, malva, amygdalinum etc. non quatenus amplificant ureteres, (quod in se ridiculum) sed in quantum spasmus crispationis demulcent, prout aliquot foci externi.* “Wherefore the before mentioned emollients, marshmallows, mallows, almonds, &c. are of service, not by enlarging the ureters, (which supposition is an absolute absurdity) but by asswaging and relaxing the spasmodic contraction, like some external fomentations.”

However, by the unanimous consent of physicians, the use of emollient and lubricating remedies stands recommended for the easier expulsion of renal stones.

By opening them with opiates and anodynes.] The singular use of these has been already mentioned at §. 202 and 229. Enormous tortures often ensue, when a renal stone begins to be moved from the pelvis into the ureter, so as sometimes to exceed all possibility of bearing, even by the most robust and courageous men.

(g) De lithiasi, cap. vii. § 10. p. 695.

Certainly then these pains require alleviation, lest from want of rest, and the violence of the pains, the strength of the patient should wholly be exhausted, as has before been observed at § 998, in the chapter on the Nephritis.

But it is to be remarked, that the passage may be opened by the same, where from the sharpness of the pain, the ureter contracted through a spasm, prevents the passage of the stone. When a grain of sand falls into the eye, by its roughness it so irritates the internal surface of the eyelids, that shut close by a very painful spasm, they can scarcely be opened by any force. That the same thing happens in the ureter when a rugged stone passes through it, we learn from the acute pain, the patient then feels. But when through opiates and anodynes, the sense of pain is removed, though the cause of pain still remains, the spasmodic contraction of the ureter ceases, and the passage is opened. I have often seen, an opiate remedy having been administered; after the previous use of lubricating emollient remedies, the stone descend into the bladder, while the patient has been asleep, who upon his waking has found himself quite free from pain, and soon after has voided the stone. Trallian recommends philonium, and Venice treacle fresh made, which possesses the whole virtues of the opium mixed therewith; (b) *Si dolor remanet, et magnum imminet periculum, ne vires a vigiliis, et constanti dolore, decedant. Praestat enim lenire dolorem, et viribus ita revocatis, ad valentiora, quae calculos confringere queant rursus accedere.* “ If the pain continues, and
“ threatens great danger, lest the strength be ex-
“ hausted from want of sleep and constant pain:
“ for it is best to assuage the pain, and the

(b) Lib. ix. cap. iv. p. 534, 535.

“ strength

“ strength being thus recruited, again to have
“ recourse to more violent remedies, that may
“ break the stone to pieces.”

But as it has been observed, that different persons require different doses of opium, to lull their pains, it is always the safest way to dissolve the opium in water, and administer it by spoonfuls, till it has the proper effect, rather than give the whole in a single dose. Such a prescription is to be found in Boerhaave's *Materia Medica* at this number, which contains two grains of opium, and half an ounce of which is to be taken every hour. But where the pain proved very violent, I have prescribed the same quantity every quarter of an hour, or even every half quarter, till, the pain being asswaged, the patient fell into a pleasant dose.

By forcing the stone forward with gentle diuretics prudently managed.] It has before been taught at § 1000, that many were of opinion, that the sharper diuretics might force the stone through the ureters into the bladder: but the urine trickles down into the pelvis and ureters, through very minute and numerous secretory tubes, nor could this secretion increased by sharp diuretics ever effect the protusion of the stone by the urine, in consequence of the impetus of its accelerated motion. Indeed at § 1417, it has been before observed, that if a stone fixed in the ureter entirely fills up the passage, and thus prevents any urine from passing by, then the part of the ureter that is above the obstacle, is distended, and the stone pressed on by the column of incumbent urine: but this pressure increases in proportion to the height, and therefore acts most powerfully on the stone, when it sticks in the lower part of the ureter, and the protrusion of the stone then only depends on the pressure of the incumbent fluid, not on the accelerated motion of the urine.

Whence it is evident, no good can be expected from the stronger diuretics; on the contrary they may do harm, as they by their stimulus may irritate the pained parts, sometimes inflame the same, and render the urine more acrimonious.

Hence the utmost prudence and caution are necessary, when diuretics are exhibited to expel a renal stone; for sometimes dangerous symptoms arise even from the use of the milder ones; as Sydenham justly observes (*i*); “For if the stone
“ in the kidneys be too large to be forced through
“ the ureters into the bladder, these (mineral)
“ waters generally cause a fit which continues,
“ not without endangering the life of the patient,
“ till the stone gets back again into the pelvis.”

Whence he did not even dare to take manna dissolved in mineral waters, though taken in this manner it purged much sooner, and sat better on the stomach. But where he thought it certain, that only small stones were lodged in the kidneys, he declares, “there is no better remedy, either to
“ prevent the increase of small stones, or to ex-
“ pel them from the kidneys, than drinking
“ chalybeate waters, plentifully every summer.” The principal sign from which Sydenham concluded (*k*) that renal stones were small; was, if the patient had already just had a fit of the stone; concerning which matter, as also the signs of a renal stone moved, the reader may consult what has been laid down at §. 1422.

Diuretics are enumerated, and distributed into different classes (*l*): but among them, the most certain and innocent of all is water, and all aqueous liquors, as whey, &c. which have been re-

(*i*) Concerning bloody urine from the stone, p. 589.

(*k*) Ibidem, p. 707, 708. (*l*) H. Boerhaave Instit. Medic. § 1222.

commended, in the preceeding paragraph, to lessen the size of the stone.

Prudence dictates, that we should abstain from sharp and stimulating remedies, lest the pain which is usually violent in a fit of the stone, be increased, lest an inflammation of the kidneys ensues, and many other dreadful disorders; of which matter the celebrated Lobb (*m*) has more largely treated, who condemns all strong stimulants in the cure of the stone, especially where there is great pain, and a fever. Aetius (*n*) after extolling baths, fomentations, clysters, oily medicines, cataplasms, &c. declares, that these had sufficed for the expulsion of the stone in many; but if they failed, he advises diuretics to be taken; and among them, also recommends some pretty acrid; such as calamus aromaticus, the seeds of bishopsweed, candy carrot, and parsley, asarabacca, bryony, &c. But he adds the following caution (*o*): *Porro ea, quae urinam cient, ac lapidem frangunt, tunc exhibere convenit, quum vehementes dolores remittunt. Transmoto enim lapide, et ex sede agitato, dolores quiescunt. Quod si obfirmati sint lapides, plurimus potus vitandus, itemque ea, quae urinam ducunt. Fomentis autem, et cataplasmatibus, ac infussionibus, membra relaxanda, et venter per infusa et infusus evacuandus, ne ureteres, meatus urinam ex renibus ad vesicam transmittentes, comprimantur.* “ Now it is proper
“ to give those things which promote the urinary
“ discharge, and break the stone, when the vio-
“ lence of the pain abates. For the stone being
“ removed and stirred from its place, the pains
“ cease. But if the stones are fixed fast, much
“ drink is to be avoided, and also all diuretics.
“ The members are to be relaxed with fomenta-

(*m*) On the Gout and stone, ch. xvii. p. 193, &c. (*n*) Sermon. xi. chap. v. p. 254. &c. (*o*) Ibid. p. 256,

“ tations, cataplasms, and semicupia, and the
 “ belly unloaded by laxative infusions and clyf-
 “ ters, lest the ureters, the pipes that transmit
 “ the urine from the kidneys to the bladder, be
 “ compressed.”

There are some remedies, that instantly change the urine as soon as taken, yet have no great acrimony; such for instance as asparagus, for this plant instantly changes the smell of the urine: so rhubarb, saffron, pulp of cassia, &c. quickly change the colour of the urine. As therefore the virtues of these so quickly reach the kidneys, they are usually classed among the number of diuretics. From these diluted in a large quantity of water there seems less to be apprehended. However asparagus has been suspected by Helmont, (p). *Vidit namque jurisperitum, non ante afflictum lithiasi, nisi postquam a largiore asparagorum esu domum rediisset; ac deinceps, non tam calculis, quam subtilissimis arenis, per reditus, aliquot annos, singulis forte quindenis sub atroci dolore decumberet.* “ For
 “ he knew a lawyer, who had never been troub-
 “ led with the stone, till after his having return-
 “ ed home from a plentiful meal of asparagus;
 “ but afterwards for some years, he suffered the
 “ most exquisite pain at intervals, perhaps every
 “ fifteen days, not so much from stones, as very
 “ fine sand.”

It has been remarked on another occasion at §. 1258, that a fit of the gout is brought on by eating of asparagus. Now every body knows, that the most eminent physicians allow a great affinity between the gout and stone. Whence it seems safest, even to abstain from these during a fit of the stone. Perhaps they may prove serviceable at another time; for it seems probable,

that the nephritic sand pre-existed in the kidneys of the lawyer, and was not suddenly produced by his eating asparagus. For Helmont remarks, that he afterwards recovered from this calculous diathesis.

By gentle motion.] Namely, after the passages are prepared, as far as art is capable, for the passage of the stone by emollients, relaxants, and oily remedies used both internally and externally. These things premised, Aretæus recommends, (q) *Gestationes, et corporis concussiones, ad movendum propellendumque calculum.* “Carrying the person about, and jumbling the body, to move and propel the stone.” But such motions are then principally to be tried, when the pain abates a little; thus we follow the path of nature: for we observe such patients every moment shift the posture of the body, that they may obtain some ease. Moreover, a vomiting usually accompanies a fit of the stone as has been already said, whereby all the abdominal viscera are violently shook and agitated, and so the descent of the stone through the ureter is promoted; now physicians acknowledge this vomiting to be a salutary effort of nature, and therefore not to be stopped, but rather assisted by plentiful draughts of warm water, or some other softening liquid. Piso attests the utility of vomiting in the following words: *Quod in me sum expertus olim: nam cum verno tempore urinæ stillicidium per duos septenarios negotium mihi exhibuisset, ecce de repente dolor atrocissimus invadit, et non ita post vomitus, isque ita vehemens, ut in eo conatu et enixu lapillus ex angustiis ureterum, insperato certoque cum levamento in vesicam deciderit, ut deinceps nullum laborem aut dolorem semestri spatio persenserim* (r). “Which I

(q) De curat. morbor. Acut. lib. ii. cap. viii. p. 110.

(r) De Morbis a colluvie ferosa, &c. sect. iv. cap. 11. Obs. 102. p. 317.

“ have formerly experienced in myself: for when
 “ I had been troubled in the spring season for
 “ fourteen years with a kind of strangury, be-
 “ hold I was suddenly seized with a most rack-
 “ ing pain, and not long after with a vomiting,
 “ so violent, that from the excessive strainings,
 “ a small stone passed from the straits of the ure-
 “ ter into the bladder, which gave me unexpect-
 “ ed and instant relief, so that afterwards I felt
 “ not the least uneasiness or pain for the space of
 “ six months.”

But prudence dictates, that we begin by gentle motion, and by degrees proceed to such as is more violent, lest perhaps by a violent shake, a rugged or sharp stone should injure or wound the kidney or ureter; whence bloody urine, inflammation, and other bad symptoms may ensue. Therefore Aretæus also premises the very gentle motion of carrying, before concussions of the body.

S E C T. MCCCCXXVII.

THE third by obviating the symptoms; the inflammation by bleeding and other proper remedies; the pain by anodyne emulsions; the ruggedness of the stone, by oleaginous, saponaceous, and glutinous medicines.

Three curative indications are enumerated at § 1424; of the two first, namely the lessening and expulsion of the renal stone we have just treated; of course we are at present to consider those remedies that are capable of effecting this, viz. that a renal stone which can neither be diminished

nished or expelled, may be reduced to such a state as not to do mischief, or at least as little as possible; that the complaint which cannot be removed, may be rendered more tolerable.

The evils that are to be apprehended from a renal stone have been enumerated in § 1416, and for the greatest part seem to depend upon inflammation, and its several consequences, from which the various symptoms are derived. Whence we see that the greatest physicians, in curing the stone in the kidneys, have always used their utmost endeavours to remove the inflammation if present, or to prevent one from ensuing; nay even, when attempting to expel the stone from the kidneys, they have not lost sight of this object, viz. the preventing an inflammation. For although they used the milder diuretics, they added to these nitre also, so celebrated among antiphlogistic remedies.

Such a decoction is to be found in Boerhaave's *Materia Medica* at the preceeding number, in which too drachms of nitre are dissolved in three pints of the diuretic decoction.

But as phlebotomy is so highly commended by every one, for its efficacy in procuring a favourable resolution of inflammation, it is also usually had recourse to in the present case, especially if the patient is feverish, and the pain violent. Piso (s) would have the *primæ viæ* first cleared by a vomit and clysters; but it seems safer to begin with venesection; for violent reachings usually accompany the descent of a stone through the ureter, and there may be danger of the bursting of the distended vessels from these violent reachings; or the vessels of the head may be too much distend-

ed; unless this evacuation be premised; as has been before observed in the history of fevers.

Nor does phlebotomy only answer this intention; it may also facilitate the passage of the stone through the ureter; as Aretæus excellently remarks (*t*): *Si calculi jam constiterint, adestque inflammatio, venam cubiti, nisi aetas prohibeat, secato: bene fluidus autem multusque sanguis exeat: neque enim phlegmonæ tantum evacuatione mitigantur, sed etiam calculorum incuneationes vasorum inanitione laxantur; quin etiam per miētum calculi elabuntur.* “ If
 “ the stones stop in their passage, and an inflam-
 “ mation comes on, open a vein near the bend of
 “ the arm, unless the age of the patient forbids:
 “ and let a considerable quantity of blood be dis-
 “ charged from a large orifice: for the inflamma-
 “ tion is not only abated by the evacuation, but
 “ also the stones are loosened from the inanition of
 “ the vessels; and moreover are voided with the
 “ urine.” In another place (*u*) he directs the vein of the ankle, which runs straight to the kidney, to be opened: *Nam sanguinis a renibus effluxiones calculorum inhæssiones cohibent. Inflammatio enim colligata tenet omnia: Evacuatio autem solutio est phlegmonis.* “ Now discharges of blood from the
 “ kidneys prevent the inhesions of stones. For
 “ inflammation constricts every thing. But eva-
 “ cuation resolves the phlegmon.”

Ætius also advises bleeding, and that repeatedly (*w*): *Quum lapis in renibus fuit obturatus, et vehementissimos intulit dolores, sanguinis etiam multitudo periculum minitantis, materias ad tensione affectam partem advocat, ob acutos videlicet dolores.* “ When a stone has lodged in the kidney, and oc-

(*t*) De curatione Morb. Acut. lib. ii. cap. viii. pag. 109.

(*u*) De curatione Morb. diurn. lib. ii. cap. iii. pag. 130.

(*w*) Sermon. xi. cap. v. pag. 254.

“ caused violent pains, the great quantity of
 “ blood, also threatening danger from the tension,
 “ attracts matters to the affected part, to wit, by
 “ reason of the acute pains.” But he observes,
 that less blood is to be taken away, than indeed
 the degree of repletion demands; because he
 hardly expected, that the stone would quickly
 descend from the kidney, especially if large; *Qua-*
re servare oportet sanguinem in eam, quæ cum tem-
pore futura est, in corpore expensam. “ Wherefore
 “ it behoves us to save the blood, for that expence
 “ which in time will happen in the body.” How-
 ever the advice of Aretæus seems safer, who ad-
 vises plentiful bleeding in the beginning: for if
 the disorder afterwards should require a farther loss
 of blood, a more moderate bleeding may be di-
 rected, adapted to the strength and age of the pa-
 tient. At the same time however, the sentiments
 of Ætius with respect to the subsidence of the tu-
 med parts surrounding the stone, deserves no-
 tice: These are his words: *Cæterum, ubi excreverit*
venter sufficienter, quædam infundere oportet, quæ cor-
pusculorum circum lapidem sitorum, inflammationes le-
nire et laxare possint. “ But when the belly shall
 “ have been sufficiently unloaded, it is proper to
 “ pour in some medicines that may assuage and
 “ relax the inflammation of the corpuscles situated
 “ about the stone” (x). The other remedies
 against inflammation have been fully treated of
 before in the chapter on inflammation. The me-
 thod of relieving the pain by anodynes, and of
 rendering the passages slippery, and the asperities
 smooth, by oily, glutinous, and mild saponaceous
 medicines, has been laid down in the preceeding
 paragraph.

(x) Ibidem, pag. 255.

If from all these means, long tried in vain, no relief is found, and the stone on account of its large size and unlucky situation, cannot pass thro' the ureter, the patient is in a wretched condition, as all those ill consequences may be apprehended, which are enumerated at § 1416. Stones, if they are neither rugged or angular, so as perpetually to irritate, are often borne without any violent complaint, generally with only a troublesome sensation of weight about the region of the kidneys: nay as has been said before, large stones have sometimes been found in the bodies of persons, in whom when alive there never was the least reason to suspect such a complaint. But this happy circumstance does not always happen: for more labouring under a stone of the kidneys that cannot be expelled, are tortured with continual pain, or have but short intervals during which they are free from it; and from any violent motion of the body, especially riding in a carriage, the bloody urine and the pains, that before seemed lulled asleep, are renewed or increased. No wonder then that such patients have sometimes rather chose to undergo an hazardous operation, than suffer all their lives so many and such terrible complaints, and perpetually languish in dread of still worse symptoms.

It has before been mentioned at § 1416, that a stone lodged in the kidney, sometimes causes an inflammation in the adjacent parts, and its consequence suppuration, when the purulent matter spreading outwardly, forms a tumour, that bursting of itself, or opened by incision, discharges a large quantity of purulent matter, and terminates in a fistulous ulcer. In such a case, by examining the wound with a probe, an hard body was felt at the bottom of the fistula, which being judiciously dilated, a stone fell out; afterwards several others were discharged, and thus a cure was happily effected.

fect. However sometimes there is a necessity for introducing the forceps, four or five inches deep, to extract the stone. Cases of this kind are to be found in medical collections faithfully described by the most able surgeons (y). As therefore, nature pointing out the way, by means of a suppuration formed in the part, a passage has been made by the knife, through which the stones have been spontaneously discharged, or extracted by the manual assistance of a surgeon, an opinion hence arose, that an incision, through the integuments quite into the kidney, might be attempted for the extraction of the stone, though no abscess pointed out the way, by which the stone might be come at. The celebrated Friend remarks, (z) that in the time of the Arabians nephrotomy had been practised, but that Serapion and Avicenna both condemned the practice as highly dangerous, and almost always certainly fatal, and not attempted except by madmen and strolling mountebanks. Notwithstanding he there relates two instances of Nephrotomy performed, where the persons survived the operation several years. For instance it was performed on a condemned malefactor, and on Consul Hobson, by Dominico Marchetti of Padua, who both recovered.

Some are of opinion that Hippocrates has recommended Nephrotomy (a) in that passage, of which I have elsewhere made mention viz. § 170, 3. where mortal wounds have been treated of. Now these are his words : *Quum dolor urget, multa aqua calida lavato, et qua parte præcipue dolor est, fots tepentes admoveto; quum vero intumuerit, et extuberarit, sub hoc tempus secundum renem, secato, et pure extracto,*

(y) Memoires de l'Academie Royale de Chirurgie. vol. ii. pag. 233, etc. and vol. iii. pag. 266, etc. (z) History of Physic, part. ii. page 183, etc. (a) De internis Affect. cap. xxv. chart. tom. vii. pag. 649.

arenam medicamentis urinam moventibus curato, etc.

“ When the pain is violent, bathe much in warm
 “ water, and to the part where the pain chiefly
 “ lies apply hot fomentations; when it becomes
 “ tumid, and much swelled, make an incision
 “ near the kidney, and the purulent matter being
 “ discharged, remove the gravel by medicines
 “ that promote urine, etc.” But from this very
 text it is apparent, that Hippocrates did not mean
 that the kidneys should be cut open for the pur-
 pose of extracting the stone; but only that an ab-
 scess tending outwardly should be opened by
 incision, to discharge its purulent contents. On
 the contrary he expressly directs, that the inci-
 sion should be made near the kidney, neither
 would he have the sand or gravel drawn forth
 by any other means than diuretic remedies: the
 passage of Ætius seems also to tend this way,
 where he says (*b*): *Consistunt lapides in renibus*
juxta ventriculos (pelves) ipsorum, aut parvi, aut ma-
jores, et aliquando quidem pauciores, aliquando autem
plures, et magnitudine, et forma, et colore, et asperi-
tate, et multitudine, inter se differentes etc. Accedit ægris
loci dolor, tumore nusquam foris apparente, nisi inflam-
matio per lapillos producat. “ Stones lodge in
 “ the kidneys nigh their ventricles or pel-
 “ vis, either small or large, sometimes indeed
 “ few, but sometimes many, differing from each
 “ other in size, shape, colour, asperity and num-
 “ ber. A pain in the part attacks the patient, no
 “ tumour ever appearing outwardly, unless an in-
 “ flammation is caused by the stones.” Indeed,
 stones generally stick deep, for instance in the
 pelvis, and to make a passage for them, the whole
 substance of the kidney must be cut through quite
 into the pelvis; the integuments and muscles be-

(*b*) Sermon. xi. cap. iv. pag. 254.

ing previously divided, which were three inches and a half thick, in a man, who having laboured some time under continual nephritic pains, at length was seized with a violent cough, and died consumptive; in whom therefore it is probable the body was greatly emaciated. An incision of this depth was required, before Douglass, a famous Scotch surgeon, could penetrate as far as the peritoneum (*c*), who found a portion of the gut colon placed betwixt it, and the convex surface of the kidney; and after that gut was removed, a large nerve presented itself, lying just across the place, where the kidney ought to have been cut*. Whence he justly concluded, that nephrotomy could not possibly be performed with safety on a living subject; and condemns it as rash practice.

This operation is attended with insuperable difficulties. For the kidneys are variously placed in different subjects, as may be seen in Eustachius's tables. How can the surgeon, although ever so dexterous, direct in such a deep wound his knife, so as to divide the substance of the kidney quite to the pelvis? What a risk of a most dangerous, nay almost fatal hæmorrhage? Besides, he can never know the situation, figure, and size of the stone, which he attempts to extract. Before a stone in the bladder is extracted by lithotomy, the operator can examine the stone with a catheter, in the present case no such thing can be attempted. Whence it might easily happen, that after so deep and cruel an incision, the stone could not possibly be extracted. For how can a surgeon introduce the forceps as far as the stone through such a deep wound? How can he open the blades of the forceps to catch hold of the stone? How

(*c*) Medical Essays, vol. I. pages 188, 189. * It is necessary to be remarked here, that the kidneys are situated without the cavity of the abdomen.

can he be certain that no part of the substance of the kidney or pelvis, is intercepted between the teeth of the forceps with the stone? What a cruel butchery, should this happen!

When Tulpius found, in the body of a man who died of a disorder in his kidneys and breast, a remarkable large stone in either kidney, spread into four branches throughout the whole kidney, he exclaimed: *Viderint illi igitur, qui satis speciose docent, ex incisio renibus calculos eximere, quam turpi ignominie prostituerent et se et artem suam, siquidem aliquando inciderent in calculum tam firmiter renibus innatum.* “Hence then those, who speciously
 “enough advise the extraction of stones through
 “an incision made into the substance of the kidney, may see to what shameful ignominy they
 “would prostitute both themselves and their profession, should they at length meet with a stone
 “so firmly attached to the kidneys.”

But the great Hevin has collected every thing hitherto known concerning Nephrotomy with solid erudition, and after weighing every circumstance nicely, and comparing them together with great judgment, has at length concluded, that Nephrotomy ought not to be attempted, unless a previous abscess points out the way; of which when there is an absolute certainty, he advises the abscess to be quickly opened by incision. I am entirely of the same opinion (*e*).

That such ulcers are difficult of cure is apparent, as they are situated so deep, that the surgeon can scarcely reach the bottom with his knife. Whence Aretæus, as I have observed upon another occasion at § 1002, pronounces ulcers of the kidneys, not indeed mortal, but incurable, and says

(*e*) Memoires de l'Academie Royale de Chirurgie, vol. iii. pages 238, 332.

that they continue as long as the patient lives. Hobson, from whom a renal stone was extracted by Nephrotomy, ten years after had still a fistulous ulcer in his loins, though he was well enough to ride forty or fifty English miles a day on horseback. However, where all the calculous matter that lay concealed in the kidney, has been expelled this way, and no fresh stones have been generated, a perfect cure has ensued, as we learn by some cases related in medical history (*f*). It is an excellent remark, that such abscesses have sometimes a double opening, one into the very substance of the kidney, the other into the adjacent adipose membrane that surrounds the kidney, which is usually thick in that part. Whence it is directed, to try, by introducing a finger into the sinus, whether any obstacle can be found, that prevents a free passage to the bottom of the ulcer; and if any is discovered, the best method is to make an incision through it (*g*).

A remarkable case of a fistulous ulcer generated in the fat surrounding the right kidney, is related in the Haarlem collections (*h*), which shews how much may be expected in even the most difficult cases, from skilful and courageous surgeons, who dare attempt, and perform with great dexterity, what has been determined upon mature consideration.

A painful tumour arose on the right side of the loins in a maiden aged twenty-eight years, which suppurating, an issue was procured for the matter, by opening the abscess with a lancet, and after some weeks the complaint was supposed to be perfectly cured.

(*f*) Ibidem, pag. 324. (*g*) Ibidem, pag. 329. (*h*) Haarlemsche maatschapp. vyfde deel, pag. 170. etc.

But some months after, a very small swelling appeared immediately above the brim of the right os ilion, at the distance of about five fingers breadth from the spine of the back; this swelling broke of itself, and discharged a quantity of bloody water, with a small mixture of purulent matter. The discharge from the ulcer, was sometimes more, sometimes less; but generally very large, so that several napkins were not sufficient to absorb the humour, which sometimes made its way through them and dropped on the floor. This troublesome disorder she had borne three years, before she would apply for assistance to that very able surgeon Ten Haaff, who attentively examining the complaint, discovered the following circumstances.

The orifice of the fistula was so small, that it would hardly admit the round end of a small probe: this narrow orifice had a communication with a wider cavity, into which the probe was introduced full nine inches, before it reached the bottom; which he imagined was situated in the fatty substance surrounding the right kidney; which he judged was very thick, because the patient was jolly.

He opened the whole fistula from top to bottom at one incision, with a bistory, by the assistance of a director, and on account of the fatness of the subject, the wound was very deep; inso-much that the lips of the wound were three inches thick; nor was there any remarkable hemorrhage. He filled the cavity of the wound with pieces of sponge covered over with lint, and fixed the dressings on tight according to the rules of art, which were not removed till the third day after the operation.

The dressings being then taken off, which was done without difficulty, as they were quite wetted

wetted through, the whole bottom of the fistula appeared to the eye : it was an open canal, which was capable of receiving a finger in its cavity ; narrower however towards the orifice. Its surface was smooth and shining, and covered with a thick membrane ; especially about the orifice of the fistula ; for towards the bottom it was thinner from its ascending.

Near the bottom, the canal of the fistula terminated in a bag so expanded, that its extremity could scarcely be reached by the tip of the forefinger ; whence the preceeding diagnosis was confirmed, which had determined that the bottom of the fistula was placed in the fat which involved the right kidney. The wound was dressed in the usual manner ; and after some days the lips having subsided and become soft, and the wound suppurating, the bottom of the fistula was again examined ; the right kidney might now be felt with the top of the forefinger, though no defect was discovered therein ; but in the great bag that formed the bottom of the fistula, a lesser cavity was observed, the orifice of which was straightened by a tense cord that ran across it. There was just reason to fear, that the disorder could not radically be cured, unless this cord was divided ; which however could not be done so safely as might be wished ; as this cord seemed to be a large nerve ; which being cut through, many bad symptoms were to be apprehended.

Every circumstance being duly weighed, the result was, to divide this cord at one stroke. This while doing caused an intolerable pain from the hip quite down to the toe : however no hemorrhage ensued, whence he was confirmed in his opinion, that this cord was a nerve. The acute pain was of no long continuance, but a disagreeable sensation of tingling remained, with a

coldness and want of feeling in the part, especially in the thicker part of the thigh; these symptoms gradually diminished, and in a few days entirely disappeared. Afterwards, the right kidney could be felt more distinctly; which however did not appear bare, but covered: and as no lateral sinusses were perceived, the whole intention of cure was now directed to the healing of the fistula; which was happily effected in about two months, a very deep cicatrix being left; which surgeons usually reckon a good sign; from thence concluding that the sides of the sinusses and of the fistula, mutually pressed together, have entirely grown to each other, so as to leave no cavity remaining, in which humours may again be collected, whence a renewal of the disorder might happen, that was thought cured.

From this fortunate cure that celebrated surgeon concludes, that nephrotomy is not so difficult, as he imagined before. However, he owns that no surgeon ought to attempt it, unless certain that there is a stone in the kidneys, which has produced an abscess, which may point out the way; for no one, although he knew there was a stone in the kidneys, could exactly determine in what part of the kidney the stone was lodged. But all these things rather confirm what has been already said concerning nephrotomy.

S E C T. MCCCCXXVIII.

FOR no certain dependance can be placed on the specific Lithontriptics hitherto discovered.

As the stone is so dreadful and frequent a malady, no wonder, many attempts have been made

made to discover a remedy that would dissolve the stone.

It has before been proved, that those elements, separated from each other, have flowed in healthy humours, which afterwards, united together, form an hard stone. As long as the elements remain severed from one another, they in no respect injure health; they only become noxious, if united. A most perfect cure therefore would be obtained, if such a remedy were known, that was naturally disposed to separate the concremented elements of the stone, so that they might again be wholly dissolved in the fluid with which they are bathed, and from which they originally concremented, and thus without trouble be evacuated from the place, where concremented they produced the stone.

Thus, for instance, to cure the stone in the bladder such a remedy is wanted, as, mixed with the urine collected in the bladder, would be disposed to dissolve the concremented particles of the stone in such a manner, that the band being destroyed by which they cohere together, being again dispersed in the urine, they may be expelled along with the urine. Many medicines have been tried, by applying them to human calculi voided, or extracted by Lithotomy, but to the best of my knowledge, spirit of nitre alone is capable of dissolving a stone entirely, and indeed with great effervescence, as has been observed at § 1414. from the observations of the celebrated Hoffman. But three times the quantity of strong aqua fortis to its weight, was required to dissolve a stone about the size of a coriander seed. The solution was turbid, whitish, and a little thicker; being fully saturated with oil of tartar per deliquium, an effervescence indeed, but no precipitation ensued: this mixture was yellowish and pellucid, of a ni-

trous taste, as nitre was thus regenerated, as chemical experiments prove.

But it is sufficiently apparent, that this acrid menstruum cannot be applied to the stone in the human body; for it would destroy the parts thereof, in which the stone was lodged. Helmont has excellently described the qualities of a remedy, fit to dissolve the stone (i): *Aptum sit in urinam mutari, ut scilicet locum affectum tangat. Habeat in se potestatem solvendi repagula calculi. Donum dei namque est; quod ars non parat, at duntaxat separat eruitque. Possideat istud in proprietate specifica et appropriata; non autem in secundis qualitatibus; caduca quippe plerumque sunt, vel qualitatum truculentia infamia. Sit subtile, ut quaquaversum eat, suumque eminus objectum demoliri queat. Amicum sit naturæ, ne scilicet cuncta pervertat etc. Errant proinde, qui solis corrosivis hanc conscribunt monomachiam: secundis nempe qualitatibus nimis fidentes, indormiunt male securi, et proprietatibus specificis neglectis, posthabitis quoque appropriatis, in objectum proprium tantum distentis, in obscurum ivere. Non enim struthio ferrum, aut aviculæ filices, uniones, lapillos, corrosionis qualitate æmula conterunt. Virtus est solvendi repagula, obicesque tartareos. Hanc meditari, hanc imitari, convenit.* “ It is readily
 “ changed into urine, that it may reach the af-
 “ fected part. It possesses the virtue of un-
 “ loosening the bands of the stone. For it is the
 “ gift of God, which is not prepared by art, but
 “ is only separated and forced out thereby. It
 “ possesses this specifically, and not from its se-
 “ cond qualities; for they are generally deceit-
 “ ful. It is subtile that it may afar off be able
 “ to destroy its object. It is friendly to nature,

(i) In Capitulo: Supplementorum Paredoxon Numero critico, § 56. pag. 560.

“ left it should disturb the whole frame etc.
 “ They mistake who ascribe this virtue to corro-
 “ sives only : too much confiding in second qua-
 “ lities, and forgetting, too secure, the specific
 “ properties, and also neglecting the appropriated
 “ ones, wholly intent on their own object, they
 “ have strayed in the dark. For neither does
 “ the ostrich digest iron, nor the smaller birds
 “ stones, pearls and flints, etc. by the rival quality
 “ of corrosion ; but by a power of dissolving
 “ obstructions and tartareous concretions. This
 “ ought to be meditated on, this should be imitated.”
 Nor is it strange, that he should think the stone
 dissolvable, when he boasted that he possessed the
 Alcahest, or universal solvent, by which all things
 were said to be so thoroughly dissolved as to
 flow like water. Moreover Cardan writes, *sua*
etate, virum per Longobardos oberrasse, qui, paucis
diebus, quodam poculo passim, secure, certo, atque
breviter, sanabat: additque judicium, se non dubi-
tare, hunc virum in inferis esse, quod moriens artem
suam mortalibus inviderit (k). “ That in his age
 “ a man had strolled through Lombardy, who in
 “ a few days, with a certain potion every where,
 “ safely, certainly, and quickly cured : and sub-
 “ joins his opinion, that he had not the least
 “ doubt, but that this person was in hell, for
 “ not having imparted his art when on his
 “ death bed for the benefit of his fellow crea-
 “ tures.” (k)

Therefore, because nothing certain appears hi-
 therto, about such a menstruum perfectly dis-
 solving the human calculus, and yet at the same
 time so mild, as not to injure the parts containing
 the stone, the most skilful of the profession have
 began to consider, whether the stone may not

(k) Idem de Lithiasi, cap. vii. pag. 697. col. 2.

be so changed as to break into smaller pieces, and thus be more easily expelled from the body. For several instances are related in medical history, which show, that the stone in the bladder, when touched roughly with a catheter, has broke to pieces, which afterwards being expelled with the urine, a perfect cure ensued. But this seldom happens, and only in very brittle stones; but they are generally harder, nay sometimes very hard. Aretæus seems to have almost despaired of this matter (*l*): for he says: *Lapis magnus tolli nequit; neque enim potione aut medicamento frangitur, aut circumteritur*: “A great stone cannot be taken away; for it is neither broken, or wasted by drink or medicine:” Whence also in the cure of a renal stone, he especially recommends those things which expel stones (*m*). But that chapter is mutilated, and perhaps something concerning medicines that waste the stone was contained in those parts that are wanting: for in another place, (*n*) the following expression is found; *calculi vero medicamentis potabilibus conterendi sunt*. “But stones are to be wasted away by liquid medicines.” He afterwards mentions some remedies for this intention (but enumerates more simples, in the passage before quoted). But that he did not repose firm confidence in these, is apparent from hence, that after having enumerated them, he immediately subjoins; *Et quotcumque experientia optima comprobavit*. “And as many soever as experience has proved good.” At present, medicines that gradually diminish the bulk of the stone, as if by wearing it away, are usually called Lithontriptics by physicians; which word

(*l*) De causis et signis Morbor. diuturn. lib. 2. c. iv. p. 54.

(*m*) De curat. Morbor. diuturn. lib. 1. c. vii. p. 130, 131.

(*n*) De curat. Morbor. Acut. lib. ii. c. viii. p. 109, 110.

to the best of my knowledge, is not even once met with in Aretæus. The human calculus is not a simple homogeneous body, the component parts of which are wholly similar, because formed of such; but examined chemically, affords the same products, as are extracted by fire from the other parts of animals; volatile salt, water, and oil; a black friable caput mortuum remaining, which, all the thick pitchy oil being expelled or consumed by an open fire, leaves an earth no longer cohering together.

Hence not without reason it was imagined, that if one or more of the constituent parts of the stone could be separated from the rest, then in such case the cohesion of the others must be diminished; and so the stone, which before was hard, be rendered friable, and capable of being broke to pieces by a slight force. Now as the volatile salt was expelled from the stone through fire, and the most quickly made its escape, the separation of this from the other parts was more especially expected; and as quick lime upon the addition of sal armoniac, immediately emits a most subtle volatile alkaline spirit, that diffuses itself throughout the adjacent atmosphere, and the same also happens if it is mixed with urine (o), it hence seems as if quicklime had long ago been thought of, as a remedy for the stone.

Thomas Bartholine says: *Constat autoritate Basilii Valentini, aliorumque, nihil in calculi profligando utilius spiritu calcis vivæ, mibique iterum iterumque compertum, aquam calcis vivæ ostreorum, mutylorumque, solvere calculos ordinarie ab ægris exsectos in mucilaginem, si aliquot dierum leni. fotu in calido simul detineantur.* “It is evident from the authority of Basil Valentine and others,

(o) Boerhaave's Chemistry, process 97, pag. 315.

“that

“ that nothing is more useful in curing the stone
 “ than spirit of quick lime, and I have again
 “ and again experienced, that lime water pre-
 “ pared with the calcined shells of oysters and
 “ muscles, commonly dissolves stones extracted
 “ from the human body, into a mucilage, if they
 “ are digested together some days in a gentle
 “ heat.” (p) However he observes, that the lime
 water ought to be very strong. In another place
 he relates that Dickinson a famous English che-
 mist in the last century, *in calculi affectibus laudare*
ceu decantatissimum remedium aquas antinephriticarum
herbarum aliquamdiu cum calce ovorum bene calcinata
excoctas. “ Extols in calculous complaints as a
 “ most noted remedy, the distilled waters of the
 “ antinephritic herbs boiled some time with egg-
 “ shell lime thoroughly calcined (q).”

Others have thought, that the cohesion of the
 stone would be destroyed, if the earth enter-
 ing into the composition of the stone, could be
 separated from the other parts: as earth consti-
 tutes the principal stability of bodies, nay and
 very strongly resists an intense fire.

But the celebrated Hales has demonstrated by
 ingenious experiments, that air is firmly united
 to the substance of vegetables, animals, and mi-
 nerals, and constitutes a considerable part of the
 whole bulk of these bodies, and coheres so strong-
 ly to the other parts, as to require often a fierce
 fire, to dissolve the union (r). Now air while
 it thus adheres to bodies is void of elasticity:
 and as soon as it is loosed from its connexion
 with the other parts of the body in which it is
 contained, it then recovers its former elasticity,
 and expands itself on every side; but these
 matters have been already spoken of at § 1414.
 Hales was astonished (s), that above one half of

(p) Epist. Medic. cent. iv. Epist. lxxvi. p. 395. (q) Ibid.
 Epist. xcii. p. 470. (r) Vegetable Statics, p. 155. (s) Ibid. p. 188.
 the

the whole stone was mere air; for so large a quantity of air he had never seen extracted from any other body, whether animal, vegetable, or mineral. It was more wonderful, that the unelastic air (called fixed) contained in a stone, the bulk of which was not above three quarters of a cubic inch, when expelled by fire, soon became elastic, and filled the space of five hundred and sixteen cubic inches; and therefore the volume of elastic air was to that of fixed air contained in the stone, as 645 to 1. What an enormous difference!

In another place (*t*), he put a small renal stone of a reddish colour into a Florence wine flask, filled with cold water; and added a piece of another stone that was very hard. He hung this flask over the fire: (these vessels bear the heat of boiling water without any danger of their breaking) when the water boiled, the air copiously issued from the renal stone in the form of bubbles; and the stone was raised up from the bottom, and strongly agitated to and fro; whence he compared that stone to the nucleus of a comet, to the tail of which, the aerial bubbles issuing from the stone, bore a considerable resemblance. But when fresh water having been poured on, the ebullition ceased for a minute, during this period no air issued out of the stone. After this renal stone had been boiled three hours in water, it was found to have lost two thirds of its weight. But the harder stone that had been boiled the same time was not sensibly lessened; although some quantity of air had issued out of it during the time of its boiling. He likewise observed, that when he restored the quantity of water evaporated in boiling, by the addition of coldish water, all expulsion of the air

(*t*) Hæmastatics on the animal calculus, exp. ix. p. 226.

ceased,

cead, neither did it return, till after the water had again boiled a considerable time.

It therefore air can be expelled from the stone, it is certain that its bulk must be considerably diminished. But it also seems probable, that the fixe air, distributed through the whole substance of the stone, when, recovering its elasticity, it issues out of the stone, by mutual contact removes the other constituent parts of the stone; as its volume is suddenly increased, and thus may remove all the adjacent particles from their former situations. Whence it follows that not only the size of the stone is lessened by the expulsion of the air; but also the cohesion of the parts of the stone with each other, is weakened; and so it may be rendered friable.

It is likewise apparent, that all stones do not with equal facility part with this fixed air, as the experiment of Hales just cited proves. The same is confirmed from various experiments made by the celebrated Lobb on lithontriptics (*u*). For he attests, that he knew for certain, the stone might be dissolved by every thing that was capable of separating the particles of air, and of expelling that fluid from it, &c. for seeing that the particles of air are intermixed with the other parts that compose this concrete, by the want of, and egress of the air from it, passages, vacant spaces, and distances between the other component parts must be created, that is, the stone must be dissolved. He steeped hard flints, and bits of marble, in lemon juice (*w*), soon after air bubbles began to issue from these bodies under the form of froth, such as is collected upon the surface of liquors, constantly increasing in quantity, for several hours. But at the same time a very fine,

(*u*) On the Stone, p. 169, &c. (*w*) Ibid. p. 4, 5, and 6.
light,

light, white dust fell to the bottom of the vessel. Whence he concluded, that the dissolution of the stones mentioned, was effected by the acid particles of the lemon juice destroying the union that existed between the particles of air, and the other particles of which these different stones were composed. From whence it seems probable, that those particles of air were the bands which cemented together the other component parts of the different stones. The famous physician of Basil in Switzerland, Staechel, has made several very ingenious experiments, to discover the nature of flint stones, and animal calculi; as has been before mentioned at § 1414, 1423, 1425. From all these attentively weighed, Lobb concluded (x); that the stones of all animals mightily abound in an elastic glutinous matter, which has some analogy with that which water extracts from Quince-seeds; and that all those things which are able to reduce the air, concealed in this elastic matter, to an active state, are dissolvents of the stone.

But that this fixed air contributes greatly to cohesion, at least in vegetables and animals, Macbride, an eminent English surgeon, has proved by many ingenious experiments; nay, he thinks that this air constitutes the primary band of the elements: as the elements do not separate from each other till this air has been expelled (*).

This union of the fixed air with the other parts, constituting a vegetable or animal substance, is frequently so strong, as to require no small degree of fire to dissolve its connexion; and such bodies may be preserved unchanged for ages. The celebrated Hales (y) expelled by the means of fire a great quantity of air from the horns of deer;

(x) Ibid. p. 33. (*) Experimental Essays, p. 28, &c. and p. 254, &c. (y) Vegetable Statics, chap. vi. exp. 51. p. 167.

however the union of the air with the other parts was not dissolved without a strong fire; when white fumes began to issue from the receiver, then the air separated in great quantity; as also when the last foetid oil was forced out by the most intense fire possible. Moreover it is well known, that very distant descendants show in their halls, the horns of stags killed in hunting by their ancestors. On the other hand where the fixed air is separated through fermentation or putrefaction, the cohesion is lessened, nay sometimes entirely taken away. But if fixed air can be restored to the bodies from which it has been separated, the cohesion is renewed.

Macbride steeped a piece of putrid flesh, that emitted a most offensive stench, and was almost dissolved into a filthy sanies, in some liquor then in a state of fermentation: (z) within the space of an hour the stench was already much diminished, and in five hours time wholly taken away, and likewise the flesh, that before scarcely cohered together, became again firm: the same happened, when a piece of very rotten flesh was suspended over the vapour of a fermenting liquor so as every where to be surrounded with it. Now it is a known fact, that a great quantity of air proceeds from fermenting liquors, which before was fixed: this is what Helmont called the *woody Gas*; which when drawn in with the breath in a large quantity, instantly kills men and animals: and this very gas subdues all putridity, and quickly strengthens cohesion debilitated thereby, the air, as it seems, being restored, which, when the meat became putrid, separated from its union with the other parts had made its escape. All these experiments merit great consideration in the

(z) Experimental Essays, p. 131, &c.

cure of many diseases; whence they seem to be attentively considered by all physicians. We cannot expatiate on this head for want of room. Bodies seem, when their fixed air is expelled, to be rendered as it were bibulous or absorbent, and greedily seize familiar air, and again render it fixed: for it appears from the experiments of Hales, and several others, that are contained in the treatise just recommended, that this fixed air, now rendered elastic, sometimes shortly loses its acquired elasticity, and is again fixed in other bodies, that want a quantity of such fixed air.

Calcarious earths have a great affinity with this fixed air, and abound therein: but when deprived of it by strong calcination, acquire a caustic power, and become soluble in water: as soon as this fixed air is restored, the caustic property is lost, and they again become indissoluble in water (*a*). This is proved by a most curious experiment, the whole apparatus of which is described in a copper plate (*b*). He poured into a glass vessel lime water rendered very clear by filtration: in another vessel he put pearl ashes: these two vessels were joined together by an incurvated glass tube, the two ends of which were so exactly fitted to the necks of the two glass vessels, that nothing could escape through the joints. In the top of the vessel that contained the pearl ashes, an hole was bored, to which was applied the pipe of a small funnel, through which spirit of vitriol, or any other acid might gradually be dropped, to excite an effervescence; as soon the mixture began to effervesce, the funnel was instantly removed, and the hole stopped up, that the air extricated during the time of effervescence, might be forced to pass through the intermediate tube, into

(*a*) Ibid. p. 50 and 214. (*b*) Ibid. p. 215.

the other glass vessel, which contained the lime water. When this was done, within a few minutes the lime water hitherto transparent began to grow turbid, and the lime contained in this water subsided to the bottom; which collected by pouring off the liquid that floated upon its surface, produced a strong effervescence, when spirit of vitrol was dropped thereon.

Hence some phænomena are understood, which have much puzzled the greatest chemists. Volatile alkaline spirits if distilled with the addition of quicklime, never afford alkaline volatile salt under a solid form, because in them the bond of fixed air, that unites parts together, is wanting. Nor do these volatile alkaline spirits prepared with quicklime, effervesce with acids; which astonished chemists still more. But the reason is this: quicklime when joined with sal armoniac, not only attracts the acid to itself, but also the fixed air that is contained in the sal armoniac; and so in distillation, the volatile salt alone, is raised with the phlegm, deprived of its fixed air. Now as effervescence is caused by the separation of the fixed air, and its recovering its elasticity, when an alkali is united with an acid, hence alkaline salt deprived by quicklime of all its fixed air cannot effervesce with acids (c.) But it hence would follow, that such volatile alkaline spirits, provided their fixed air was restored to them, must again produce an effervescence with an acid poured on them. That this is really the case, is proved by plain experiments. For when, in the apparatus above described, the air expelled by reason of the effervescence of the acid with the alkali, is forced to pass through the incurvated tube into the vial that contains an alkaline volatile spirit prepared with

(c) Experimental Essays, p. 49, 50.

quicklime,

quicklime, in ten minutes the spirit is so saturated with the air which it unites to itself, that afterwards it will strongly effervesce with acids (*d*). The same effect also is observed, when air extricated from fermenting bodies, is by the like artifice drawn into a vial that contains alkaline volatile spirit prepared with quicklime (*e*). Moreover the same air separated by fermentation, received into lime water, precipitates the dissolved lime to the bottom (*f*), so that in the space of five days, three grains of calcarious earth were collected from six ounces of lime water.

But though this fixed air, when loosed from its connexion with the other parts of a body, becomes elastic, yet it seems to differ in its properties from the air of the atmosphere, and particularly it more quickly and readily unites with bodies that are deprived of fixed air. For fixed air separated through effervescence, in the space of ten minutes rendered volatile alkaline spirit, capable of effervescing with acids. The same air separated by fermentation, in the space of five days precipitated the calcarious earth from lime water; which notwithstanding it had been left in an open vial fourteen days, the air of the atmosphere having free access thereto, had not deposited during that time the least particle of calcarious earth. (*g*) Nevertheless fixed air seems to exist in the air of the atmosphere, or the air that surrounds us may be rendered fixed. For we perceive that lime water if long kept, collects a scum on its surface; which is nothing else but calcarious earth, that by the action of fire may be changed again into quicklime. Moreover quicklime long exposed to the air, loses its causticity, and solubility in water (*h*).

(*d*) Ibid. p. 52, 53. (*e*) Ibid. p. 48. (*f*) Ibid. p. 227.
 (*g*) Ibid. p. 226, (*h*) Ibid. p. 258, 259.

Nieuman observes, that he kept spirit of sal armoniac prepared with quick lime, ten years, which then had almost lost its whole volatility and subtility, and strongly effervesced with acids (*i*). This seems to have happened, because the spirit in this long space of time, was again saturated with fixed air, the presence of which is required to cause an effervescence.

The celebrated Boerhaave (*k*) who was not used to determine easily, where any doubt still remained, says: *Dubitatum quandoque, an omne illud, quod ita gigneretur, foret quidem ejusdem ita naturae, ut eodem nomine elastici aeris appellari debeat? an vero corpora, certa lege resoluta in partes minimas, omissa natura sua prima, forte vera transmutatione, permutarentur in aerem hunc elasticum, qui, dein rursus concretus aliis, iterum firma redderet nova corpora? an adeoque, praeter aerem communem elasticum aliud illi simile non idem, in rerum natura obtineret?* “ It has sometimes been doubted, whether all that might be thus generated, would be so far of the same nature, as that it ought to be called by the same name of elastic air? Or, on the other hand, whether bodies being resolved after a certain manner into their minutest particles, might not have their nature altered, and, by a real transmutation be changed into this elastic air, which afterwards being again concreted with other things, might produce new solid bodies? And consequently whether, besides the common elastic air, there was not in nature something else very much resembling it, and yet not perfectly the same.”

The experiments that have been instituted by Dr. Joseph Black concerning the fixed air concealed in bodies, &c. particularly ought to be

(*i*) Ibid. p. 51. (*k*) Chem. vol xi. p. 532.

read (*l*). For they are ingenious, and made with the utmost care; and Macbride above mentioned supposes these known, that his own experiments may be the better understood.

Now as so great a quantity of fixed air may be contained in a stone, as to constitute above one half of its whole bulk, there are great hopes, that a stone may not only be diminished in size from the expulsion of this air, but also be rendered brittle; as the foregoing experiments demonstrate that this fixed air contributes much to the cohesion of bodies. Every body knows, that the air is expelled from stones by fire and acrid eroding substances; but these cannot be applied to a stone contained in the human body. Whence this hope alone seems left, that such medicines may be discovered, as extract the fixed air from the stone, and at the same time are so mild as not to injure much the parts wherein the stone may be contained. Now as quicklime seems to possess these properties, the reason is hence plain, why lithontriptic remedies of high reputation have been prepared from quicklime.

It is worth while to consider the lithontriptic medicine of Mrs. Stephens, which obtained the approbation of the British legislature, and for the discovery of which she received a considerable reward.

The origin of this remedy is thus described (*m*). Mrs. Joanna Stephens, by birth a gentlewoman, and a person of strong natural parts, about the year 1720, began to administer egg shells baked in an oven, and afterwards reduced to powder, as a solvent of the stone; some time after, she began

(*l*) Essays and Observations physical and literary, vol. ii. p. 157, 225. (*m*) Hartley on Mrs. Stephens's Lithontriptic, &c. p. 5, 9, 7.

to burn the egg shells in an open fire, till the blackness at first acquired went off, and they became white again; and thought she observed, that they became more efficacious in proportion as they were longer exposed to the heat of the fire: the dose she gave was a scruple three times a day in a glass of white wine. But as an obstinate costiveness very frequently ensued from the use of these powders, she added a small quantity of soap; which she imagined might also assist the dissolution of the stone. She pursued this method some years, which she found expelled gravel from the kidneys, and even sometimes dissolved stones in the bladder. At the expiration of the twelfth year, she began to administer calcined egg shells in a larger dose; often also with the addition of half an ounce of soap in the form of a draught. And as this medicine was of remarkable service to a man upwards of eighty years of age, who for some time had been afflicted with the symptoms of a stone in the bladder, and during the use of this remedy, voided a great many thin shells, and fragments of stone, she had a more striking instance of its lithontriptic virtue, than in any of the former cases; whence she afterwards gave both the powder of calcined egg shells and soap in a still larger dose, and in like manner with greater success. From which it appears, that the virtue of this medicine depends on calcined egg shells and soap.

As the fame of this remedy spread abroad, and it might easily be discovered, Mrs. Stephens now began to mix other ingredients with it; garden snails cleansed and burnt in a covered crucible, and then beat into fine powder, she added one part of this powder to six parts of egg shell lime, and directed this mixture to be kept in an earthen jar close stopped. She added also a small quantity

ty of buckshorn plantain burnt to ashes; which she also mixed with the decoction in which the Venice soap, was dissolved: she added also chamomile, fennel, burdock and parsley; or the roots of these plants, if she could not procure the green herbs; to these plants above enumerated she substituted sometimes others, mallows, marshmallows, &c. without observing the least difference in the effect of the remedy (*n*). Indeed she acknowledges, that she only added these and the like ingredients, to prevent a discovery of the medicine.

Whence these ingredients being omitted, which were supposed not to contribute in the least to the efficacy of the medicine, it was rendered more simple by administering only the powder of calcined egg shells three times a day, in any convenient vehicle, to the quantity of two scruples, two scruples and an half, or an whole drachm, drinking after each dose a third part of a decoction that contained two ounces and an half, or three ounces of Castile soap; the soap being dissolved in eighteen ounces of water. This decoction was sweetened with sugar or honey to the patient's palate (*o*). Whence the proportion of the powder to the soap, was as one to eight; by this means it generally happened, that the body was neither too loose, or too much bound: but as the powder would bind the body, the soap would loosen it, and both imparted a lithontriptic virtue to the urine; the quantity of each was increased or diminished according to the different state of the bowels. If notwithstanding this precaution, a diarrhœa came on, recourse was instantly had to opiates, lest the lithontriptic vir-

(*n*) D'Escherny, brother in law to Mrs. Stephens, page 14, etc. (*o*) Hartley on Mrs Stephens's lithontriptic, etc. pages 5, 6, 7.

tue of the remedy should be carried out of the body. The highest dose of each medicine is proper for persons of a robust constitution, and who have a strong stomach; for many the middle dose is sufficient. But it will be best to administer only the smallest dose, and to render the powder more mild, in habits where the stomach is weak, or the pain in the urinary passages violent; the powder may be rendered milder by a less degree of calcination, or by exposing it a longer time to the air; for thus it is well known the fiery property of lime of every kind is mitigated. The smallest dose is also sufficient for aged persons, as stones formed in them are more readily dissolved. But younger people ought to take as large a quantity as the stomach will bear: for an author of repute affirms, that he is certain from repeated experiments, that these remedies act more slowly in them; neither to the best of his knowledge has there ever been an instance of the constitution's being injured either through the increased quantity of these medicines, or a long continued use of them. Wherefore he lays down as a general rule, that as large a quantity is to be taken by every one, as the stomach will bear: for the larger the quantity taken, the more quickly does the stone putrefy as it were, and dissolve, and the coats and fragments of stones are rendered more soft and putrid, which generally are voided with the urine, after the medicine has been taken for some length of time.

For that the urine is changed by the use of these lithontriptic remedies, the author observed in himself, when afflicted with the symptoms of a stone in the bladder (*p*). For as soon as he began to take these medicines, he found his urine become

more volatile than usual, and in smell resemble stale putrescent urine, it also was rendered very alkalious: for it effervesced with oil of vitriol, oil of sulphur by the bell, spirit of nitre, spirit of sea salt, vinegar, and lemon juice. All which circumstances indeed are commonly met with in those who take these medicines.

Moreover he proved by plain experiments, that human calculi digested in his urine, while he took these lithontriptic remedies, decreased in weight, though the same digested in natural urine an equal length of time were increased in weight (*q*).

Whence he concluded, that the urine by a plentiful use of quick lime, and Castile soap, acquires a lithontriptic power, but is at the same time rendered putrid and alkalious. Now as physicians may, in diseases, from the different changes of the urine, form a judgment of the state of the blood, from whence the urine has been secreted, physicians of great eminence have been fearful lest the putridity, and alkaline acrimony, should corrupt the sound humours of those who used these medicines. The great Mead inveighs prettily sharply against Mrs. Stephens's medicines (*r*), and blames some gentlemen of the faculty for having acted a part much beneath their character, first in suffering themselves to be imposed on, and then encouraging the legislature to purchase an old woman's medicine at an exorbitant price. For he was afraid of the highly caustic power of this remedy, it might prove of some service towards expelling small gravel, but could never break calculi of a stony hardness, and a long continued use thereof might not be free from great danger. However this great man confesses with his usual candour, that lime water with-

(*q*) Ibid. page 33, and the following. (*r*) Medical Precepts, page 175.

out soap, has been of remarkable service; which, it is true, was prepared of the calcined shells of oysters, and other shell fish, which he believed was different from quicklime. It appears notwithstanding from the experiments made by the celebrated Whytt during ten years, that lime water prepared with calcined oyster shells is more efficacious than that which is made with stone lime(s). The Dutch make the lime that is used in building their houses, of all sorts of shell-fish: with this lime they prepare lime water. If this quicklime is thrown into urine fresh made, a great ebullition, and a very great heat are instantly excited, and likewise a very sharp, volatile vapour exhales, that strikes the nostrils like a flash of lightning(t). It is true indeed the learned author says; *Omnia autem hæc magis vera de calce viva saxea, quam de ostracodermatis parata*, “but all these circumstances are more true of lime prepared from stones than shell fish;” which last however he used in his chemical experiments. But at least this is manifestly evident, that calcined shells afford true and indeed efficacious quicklime. Whence the circumstance that seemed to be feared from Mrs. Stephens’s medicine, holds good in like manner in quicklime and lime water, which seems to constitute the chief efficacy of this lithontriptic; of which matter we shall hereafter speak.

The great Huxham (u) acknowledges the lithontriptic virtue of these remedies to be undoubted; but at the same time the urine being manifestly rendered alkaline, after a plentiful use of these, raises a suspicion, whether the serum and blood may not be affected likewise; which he

(s) Essays and Observations Physical and Literary, art. xviii. page 385. (t) Boerhaave’s Chemistry, vol. ii. process xcvi. page 315. (u) On Fevers, etc. page 49.

justly thinks a dangerous circumstance in persons of a tender constitution. For he had seen a gentleman, who having been afflicted with a stone in the bladder several years, had taken for some weeks soap leys; whence he fell into a putrid scurvy; from which he recovered indeed, but died, within a few weeks after, quite tabid, from a complication of disorders, and a confirmed hectic. In his bladder was found a stone that weighed above eight ounces. But the person being of a tender constitution, having been afflicted with the stone so many years, labouring under a complication of disorders, and being consumptive also, his death cannot surely with justice be ascribed to this remedy alone, though it seems to have been imprudently administered, whilst, besides a large stone, there were so many other disorders.

But whether the use of these remedies would be as dangerous in a person afflicted with the stone, but in other respects perfectly sound, seems justly a matter of doubt. For it appears from certain, and pretty numerous observations, that many have taken Mrs. Stephens's medicines a long while, without any remarkable injury to their health. They are nauseous, and not all stomachs will bear them long; but there have been many, who in hopes of obtaining relief from the tortures of the stone, that sometimes exceed all human patience, have borne this nauseousness and loathing with great resolution. The urine of persons who take these medicines becomes acrimonious, alkaline, and effervesces with acids; but it does not hence follow, that the blood and its serum are affected in like manner by the same. For the urine contains a far greater quantity of salts, and indeed those much more acrid, than are observed in the blood, or its serum; which, when lime water is poured thereon, instantly exhale a very sharp volatile vapour.

vapour. But lime water, when poured on blood, heightened its colour indeed, but in other respects changed it very little (*w*), and no mention is made of any sharp vapour exhaling from the blood in consequence of this mixture. Now as the more acrid salts, that might prove hurtful if they remained longer in the body, are naturally excreted with the urine, it thus rendered more acrimonious than usual, will wash such stones as may be lodged in the kidneys and ureters, and collected in the bladder, will act a greater length of time and more forcibly on a stone contained therein; so that the external coats macerated in this lixivium may grow soft, be separated from those placed under them, and afterwards be voided with the urine: whence the bulk of the remaining stone is more lessened, and thus at last may be expelled. The celebrated Morand (*x*), as good a judge as any of this matter, who by command of the academy strictly inquired into the use and effect of these medicines, attests, that many had taken them for a long space of time without injury; some also with a manifest alleviation of their complaints; and indeed with such great benefit, that they judged themselves entirely cured of the stone. Though it does not appear from his observations, that an entire solution of the stone was effected by these medicines, notwithstanding some voided pieces of stones with their urine. But as calculous patients have sometimes a frequent inclination to make water, this expulsion of pieces of stone was not observed, till after they were able to hold their water a long time, and thus the urine impregnated with the virtues of these medicines, could act longer upon the stone contained

(*w*) Schwincke, Hæmatolog. page 190. (*x*) Académie des Sciences 1740. mem. 251, etc.

in the bladder. He observed that very hard stones, which sawed through receive a polish like marble or agate, were no ways changed or eroded by these remedies, but that softer stones were acted on by these medicines, especially in old people, next in adults, and least of all in younger persons. But as it is scarcely ever possible to ascertain the particular degree of hardness of stones in the bladder, he persuades all adults to try the efficacy of these medicines, before they submit to undergo the operation of lithotomy, which, though at present, greatly improved by modern professors, is not however free from danger. If no relief is obtained from thence, lithotomy may be undertaken with equal safety after the use of these remedies.

He has likewise observed, that if there is an ulcer in the urinary passages, which is known from the discharge of purulent urine, the pains are increased by the use of these medicines, and therefore they are not proper in this case. Nevertheless, a man thirty-four years of age, who not only laboured under the stone, but also an ulcer in the bladder (*y*), rather chose to try Mrs. Stephens's medicines, than to submit to the operation; and took them the space of three months: his pains were increased; he ceased taking them towards the end of February, and died in the April following. The body being opened, it plainly appeared, that the lithontriptic virtue of these medicines had acted upon the stone, so that there was reason to imagine that the stone would have been wholly destroyed, if the patient could have persisted longer in taking them. He relates besides several cases, which shew that the lithontriptics of Mrs. Stephens have acted upon the

stone, and have lessened its size; and that thin scales have separated from the whole circumference of the stone, which were voided with the urine; as afterwards has appeared upon the patient's being cut for the stone, or upon opening his body after death. However these remedies acted slowly; whence their use must be continued a considerable time. Other observations have shewn, that these medicines taken a long while, have remarkably relieved the symptoms in calculous patients, even in a case, where the stone being afterwards extracted by the operation of lithotomy, no marks appeared that the lithontriptics had acted on the stone, or diminished its bulk (z). A man afflicted with a stone in his bladder, had taken these medicines in a liquid form, for six months; and indeed with great success: for he was free from all pain, walked, rode on horseback, or in a carriage, and could bear any exercise or fatigue without the least inconvenience: this relief from his complaints lasted an whole year. He then began to feel a kind of heat in his bladder, together with a stranguery, and a frequent inclination to make water. These symptoms were quieted for two or three months, by bleeding, and the use of refrigerant medicines; afterwards they returned more frequently. At length the patient tired out with these complaints, courageously submitted to the operation; a stone was extracted from the bladder, that weighed ten drachms and a scruple, hard, of a close compact fabric, and of a rusty colour. There was not the least sign that the lithontriptics had acted upon the stone. During the use of these medicines, the urine constantly deposited a very fine white sediment in large quantity. After

(z) Ibid. 1743, page 136, etc.

the patient had left off taking them, very small reddish gravel was voided with the urine, in colour very much resembling the stone, that was afterwards extracted by lithotomy. The patient perfectly recovered after the operation, and enjoyed an excellent state of health.

Another calculous patient took the same medicines for three years together; at first every day; afterwards at intervals, whenever he felt the least pain; and always found relief: but never observed the least alteration for the worse in his health, from having used them so long; nay, he rather grew fatter.

From all these circumstances it may be concluded, that these medicines may be taken without detriment to health; that the bladder is not hurt by the urine, which is rendered more acrimonious from the use of these remedies; and that after a long continued use thereof, Lithotomy may be safely and successfully performed; which certainly is a matter of great moment. For though they do not seem to act upon the harder stones, yet many have received remarkable relief from their pains by the use of them, and indeed for a considerable length of time: whence it seems, that Lithotomy may be deferred without danger, as long as the patient continues exempt from the tortures of the stone. Besides, the observations of Hartley, described with great candour, confirm the action of these remedies on the stone; (a) and he has in his plates given the figures of several stones, the surfaces of which have been eroded, and rendered brittle from the use of these medicines; he also relates several cases (b)

(a) On Mrs. Stephens's Medicines, etc. pag. 14. etc. (b) Ibid. pag. 18.

of persons, in whom, upon introducing a catheter, a stone was felt in the bladder, and who during the use of these remedies, have voided many scales of a stone with their urine, and at last the nucleus of the stone itself, every symptom disappearing: in some, the bladder has been searched with a catheter three different times after these substances have been voided, and yet no stone found.

Nevertheless he does not dissemble, that it happened in two persons, that although they had voided by urine several pieces of stone, nay one thought, that after a sudden but not painful suppression of urine, he had voided the nucleus of the stone, upon searching them with a catheter, a stone was found in the bladder, contrary to expectation. In one however, for two years and an half, in the other, for almost three years after the time he wrote these observations, not the least calculous symptom was observed, or trouble from the stone upon any motion of the body whatever, nay even from riding in a coach over paved streets, by which exercise the pains of calculous patients are usually so much exasperated.

But as Mrs. Stephens's medicines contain a large quantity of calcarious matter, it has been questioned, whether these scales that are voided during the use of them, and are supposed to be separated from the stone, were not calcarious concretions applied to the stone, and slightly adhering thereto, hence subject easily to fall off; and thus by the use of these remedies the bulk of the stone rather increased than diminished; at least the diminution of the stone uncertain; because the scales voided with the urine may consist of calcarious earth contained in the urine,
and

and applied to the stone. (c) It appears from the ingenious experiments of Macbride, before mentioned, that lime water, even the clearest, and most limpid, contains a calcarious earth, which, as soon as the fixed air is restored to it, of which it was deprived by fire, instantly subsides: hence when these medicines release the fixed air, which is contained in large quantity in the stone, from its connexion with the other parts, and unite it to themselves, a calcarious earth is regenerated, from the same cause that renders the stone brittle. But yet it does not hence follow, that those scales that are voided with the urine, consist of this calcarious earth only. A citizen of Cremnitz, is mentioned by the celebrated De Haen (d), who had never taken any thing that had the least affinity with Mrs. Stephens's medicines, yet often voided *copiosissimam, albam, glutinosam, materiam, quae, pauculo tempore sibi relicta, friabiles formabat, albidosque lapillos*. "A large quantity of white glutinous matter, which, if left to stand a while, formed little white friable stones."

Besides, after the use of Mrs. Stephens's medicines, such calcarious scales only are not voided. For in a person who had been cut for the stone when ten years of age, the symptoms of a stone in the bladder returned again; which he had borne for six years; an eminent surgeon had two different times introduced a finger up the fundament, and "both times plainly felt a stone in the bladder, as large as an hen's egg." After the use of these remedies he soon "voided with his urine a great quantity of brown rotten

(c) De Haen's Ratio Medendi Pars. v. to cap. v. pag. 164. Pars. vi. to cap. v. pag. 233. (d) Ibid. tom. v. cap. v. pag. 162, etc.

“ gravel, and also a great many white scales of
“ stone. These by degrees ceasing to be voided,
“ the shells of the stone, to use the expression,
“ came forth, inasmuch as they were thick, and
“ consisted of several layers. Many of them also
“ were broad and of an irregular shape, white on
“ the surface, which being rubbed off they ap-
“ peared brown within. At last, pieces of the nu-
“ cleus itself brittle and porous were evacuated,
“ all the symptoms then entirely ceasing. The
“ same surgeon now examined the patient a third
“ time, by introducing his finger up the funda-
“ ment, but could not perceive any sign of a
“ stone” (*e*). It does not seem probable that all
these substances, which this patient voided with
his urine, were mere calcarious or other earthy
matter, but the eroded parts of the stone also
formed a part thereof.

This candid author does not deny, “ that the
“ lime of the medicines is deposited in the urinary
“ passages” (*f*). For as the urine rendered me-
dicinal through the taking of these remedies, is
usually turbid, and as it were milky, and likewise
deposits within a few minutes a white, heavy sedi-
ment, he conversed with Hales about the nature
of this sediment, that its origin and species might
be investigated, as also that of the fragments
voided with the urine, during the time these me-
dicines are taken. He put a piece of a real
human calculus into the bowl of a tobacco pipe;
into another bowl of a tobacco pipe, he put some
fragments that had been voided by a patient who
took these medicines; into a third, he put some
of the dried sediment of the urine of another
patient. These three pipes were put into a fire:

(*e*) On Mrs. Stephens's Lithontriptic, pag. 24. (*f*) Ibidem,
pag. 56.

the first two substances almost wholly evaporated; while out of twelve grains of the dried sediment, seven grains remained in the pipe. Whence it may be concluded, that this heavy earthy sediment is different from the nature of a stone; but the fragments excreted with the urine during the use of these remedies, are of the same nature as the human calculus.

(g) Moreover Stack, from his own experiments which merit a ten-fold perusal, concludes, “ that “ the calcarious matter passes unchanged into the “ urine, as he has observed in the sediments of “ different urines.” (Using a microscope he was capable of distinguishing the calcarious particles very plainly; which he has also delineated). For an human calculus macerated in a calcarious menstruum, first lost the coat which he calls the misty one; because viewed through a microscope it appeared under such a form; afterward the stone was covered with a milky hard calcarious matter; after this came off a very thin scale, on its interior surface full of very small holes; beneath this lay another thicker coat pierced with larger holes; and the same circumstance took place in all the succeeding coats, quite down to the nucleus; so that the innermost coat had the largest holes (b). These seem perfectly to agree with the experiments of Macbride. The lime contained in the lime water, is rendered visible, when it attracts to itself the fixed air from other bodies; that the human stone contains in it a quantity of such air, appears from the experiments of the celebrated Hales; Stack proves that this air is entangled in a certain glue, which he compares to the mucilage of quince seeds, which he has found to exist both in flints, and human cal-

(g) Epistle to Hartley, pag. 34. (k) Ibid. pag. 31.

culi; when an human stone is macerated in lime water, the lime now saturated with fixed air subsides, and the coats that form the stone become porous, quite to the very nucleus of the stone. Does not, at least it seems very probable, the loss of the fixed air render the coats of the stone full of little holes? And as this air, remaining entangled in the glue, may take part thereof away with in its exit, and hence render the holes of the outermost coats narrower through the apposition of this glue adhering to the sides, is not therefore this the cause, why the holes are largest in the coats nearest to the nucleus? I acknowledge these are at present meer conjectures: formed however in consequence of experiments, not the produce of a luxuriant imagination. If the Roman senate judged the person praise worthy who had courage enough not to despair of the republic in the most desperate circumstances, those great men also deserve commendation who presume to entertain hopes of solving that most difficult problem in the medical art, the dissolution of the stone.

It cannot be denied, that some progress has been made in the discovery of medicines that are called Lithontriptics, because they lessen the size of stones, and thus render them more fit for expulsion. It must be confessed however, that the most celebrated have often proved unsuccessful: for some stones are so hard as to elude the action of all remedies hitherto known. But others are met with, that less strongly cohere together, and yield to these medicines. Besides, it appears from various experiments, that sometimes the most rack-ing tortures of the stone have not only been relieved, but have entirely ceased for several months, nay years, though the stone remained in the bladder.

der. Now even this is a prodigious happiness to the poor patient.

But as it is certain from undoubted authority, that Mrs. Stephens's medicines have done service; it however often happens, that patients cannot continue the constant use of them a sufficient length of time, as they frequently occasion an insuperable nausea; hence the most eminent physicians have used their utmost endeavours to surmount this obstacle.

Indeed from the above description and history of Mrs. Stephens's medicines, it is manifestly evident, that many things have been added that increased the quantity, not the efficacy, and seem only to have been added with an intention to disguise the medicine. For afterwards, when the composition of the medicine was publicly made known, Mrs. Stephens declared all these ingredients might be safely omitted. Whence Hartley leaving out all the rest, retained only the soap, and egg shell lime, and thus much diminished the bulk of the dose of these medicines (*i*).

Notwithstanding this reformation, the middling dose for a grown person, (for they were given in different quantities according to the age and strength of the patient) to be taken every day, still amounted to two ounces and an half of soap, and seven scruples and an half of eggshell lime. And as that powder is very nauseous, and the quantity of soap large, these remedies, even thus reformed, can be taken but by few for any length of time, without an insuperable loathing in consequence thereof.

Hence the celebrated Whytt began to consider about a further emendation of these medicines. Instructed by the experiments of Hales made on the same remedies, he began to think that their efficacy principally depended on the quicklime;

(*i*) Medical Essays, vol. vi. pag. 157.

and that therefore the lime water of the shops might be substituted in the room of this nauseous composition. He was confirmed in this opinion, from the circumstance of Mrs. Stephens's having used burnt eggshells only, in her first attempts to dissolve the stone; adding the soap afterwards, to remedy the costiveness that usually accompanied the use of these powders. But as the other ingredients which enter into the composition of soap, namely oil, and the alkali called pot ash, from the experiments of Hales, conduce nothing towards the dissolution of the stone, its whole efficacy seemed only to depend on the quicklime, or lime water that is used in the making of soap. Whence omitting the soap, and eggshell lime, he resolved to use lime water only: for so the virtues of a greater quantity of quick lime might, in his opinion, be safely conveyed into the blood, and with less inconvenience. For the powder of calcined eggshells is a lime, that by being exposed sixty days to the open air, has lost much of its strength, inasmuch as it has been almost half flaked; and therefore greater effect might be expected from lime water fresh made. Besides it is well known, that a great heat is produced at the time water is poured upon the lime: whence if the lime is taken with a small quantity of liquid, bad consequences may ensue; for it has been observed that patients after taking these powders have complained of great heat and uneasiness at their stomach. But if these powders are diluted in the stomach with a sufficient quantity of liquids, it seems hardly possible any other effect should happen, than if a quantity of lime water had been drank. It seemed therefore reasonable to expect, that lime water taken in large quantities, might impregnate the urine with its lithontriptic virtues.

The celebrated Whytt justly observes, that the most specious reasoning is not sufficient to ascertain the virtues of any medicine, unless supported by experience, whence the first opportunity that offered, he made a trial of lime water on a man about sixty years of age, who had frequently voided renal stones after severe fits of the stone, of two, three, four, eight, nay and fourteen days continuance; but always, in a few days after these fits, voided one or more stones by using exercise, such as riding on horseback, quick walking, jumping, etc. and drinking plenty of diluting liquors. But having borne these complaints thirty-six years, after a violent fit of the stone that lasted two days, he was sensible the stone had arrived in his bladder; and notwithstanding he used the ordinary means which had so often succeeded before, yet all his endeavours to make it pass were in vain, the stone remained in the bladder; and half a year after this misfortune, he was troubled with frequent obstructions in making water, although without any great stimulating pain, except in voiding the two or three last drops. He perceived the stone increase, and become heavier, and upon riding or walking a mile or two, his urine was always mixed with blood: he had also lost all power of retaining his urine, so that it went from him every eight or ten minutes, which was accompanied with violent stimulating pains; yet sometimes with intervals of ease for a day or two; after sweating, and keeping himself warm (*k*).

At first he drank milk and water; in the eleventh month after the last nephritic fit he began to take soap, first to the quantity of half an ounce every day, which by degrees he increased,

(*k*) Ibid. pag. 160.

so that towards the end of the thirteenth month he took an ounce every day; and in the beginning of the fifteenth month, an ounce and an half; but without any sensible relief, his pain, bloody urine, and inability to retain his water, still continuing as before.

Towards the end of the fifteenth month, he began to drink with the soap large quantities of lime water, beginning with a pint, and gradually increasing the quantity to three pints a day. He drank no more of any other liquors than was necessary to quench his thirst; that thus the urine might arrive at the bladder more fully saturated with the virtues of the lime.

Within four or five days, after he began to drink the lime water, he recovered in a great measure the power of retaining his urine; and from that time had less pain, and less bloody urine upon using exercise than formerly; so that about the middle of the seventeenth month, although he walked upwards of six miles pretty quick, yet he retained his water for nine or ten hours together, and as he voided it with little or no pain, so he found no blood mixed with it.

Two days after, when going to bed and trying to make water, he found a stone entering the beginning of the urethra, and obstructing it; which he voided the next morning in consequence of a very violent effort to make water: the stone was smooth, about the bulk of a common bean, of a whitish colour; whereas all those he had passed formerly, were of a brown colour, and rough. It appeared plainly to be part of a larger stone; however he found great relief thereby.

Yet he still felt a stone in his bladder, and the urine deposited a great deal of white sediment, and some brownish flakes among it: during the whole of the eighteenth month he found himself
not

not so easy, the stone frequently entering the passage, and afterwards slipping back into the bladder; however his pains were not very violent, and he could retain his urine for half a day together, which he then evacuated without pain. Immediately after emptying his bladder, he always sensibly perceived the weight and pressure of the stone, if he but walked a little; but when the urine began to be collected in any quantity, this became less perceptible. The patient encouraged by this success, continued using the soap and lime water daily, which last he frequently took at his meals instead of other drink, and thought that his urine tasted a little of it.

At last, about the beginning of the nineteenth month, one night he found a stone had got into the beginning of the urethra, which in great measure hindered him from voiding any urine: however next morning after a good sleep, it came away. It was larger than the stone he passed before, and was evidently a part thereof. For some days after passing this stone, the urethra was very tender, and a little painful; which occasioned his making water more frequently than usual; but this soon went off, and ever since he has been perfectly free from all pains and symptoms of the gravel or stone, which happiness he chiefly ascribes to the lime water, as he had found no relief from the constant use of soap. Two years and an half after the expulsion of the last stone, the patient sent Dr. Whytt an attestation of the truth of the fact as described; and affirmed that he continued perfectly free from all nephritic symptoms (*l*).

Many experiments are afterwards related that prove, lime water, especially if prepared from sea

shells, acts on human stones immersed therein, so that their external surface becomes white, soft, and subject to fall off; after which lime water acts in like manner upon the inner coats; and thus lessens the size of the stone. The proportion of lime to the water poured on, is as seven or eight to one. Seven or eight pints of water are added to a pound of fresh quicklime, and after the mixture has stood five or six hours, the water is separated by decantation, or the filtre, and kept in jars close corked. He asserts, that it may be drank every day to the amount of several pints a day even by young persons. He also observes, that lime water mixed with urine, prevents the elementary particles of the stone from concreting together (*m*).

Besides, many experiments were made on the substances commonly used in diet, with a view to determine whether they might or might not lessen the efficacy of lime water in dissolving the stone? The result was, that fermented liquors, acid fruits, such as gooseberries, strawberries, cherries, apples, pears, etc. and honey, ought to be abstained from by such as used lime water with a view to the dissolution of the stone (*n*).

Drinking of lime water does not render the urine alkaline, as is the case with those who take Mrs. Stephens's medicines; which therefore seems rather to happen from the large quantity of alkaline salt that is contained in the soap. Now Hales has demonstrated that pot ashes will not dissolve the stone (*o*). Soap lees however act upon the stone; which virtue of soap seems chiefly to depend upon the lime contained therein (*p*). Perhaps soap acts also by dissolving the glue that Stack has discovered to exist in flints and human

(*m*) Ibid pag. 173, 190. (*n*) Ibid. pag. 197, to 200. (*o*) Ibid. pag. 234. (*p*) Ibid. pag. 233.

stones, as has been mentioned before. Whence the use of soap is recommended every day to the quantity of an ounce, together with lime water drank plentifully, beginning with a small quantity, and gradually encreasing the dose. If the stomach, as sometimes happens, cannot easily bear the soap, the same effect may be expected from lime water alone, if drank constantly, in large quantities, and prepared from shell lime. If the patient finds relief from the use of lime water, the author would have him persist therein resolutely for several months, nay years, if the stone should be large (*q.*) In the former part of this work, at § 605, 7. I have made mention of lime water, as very useful to clear the blood of a muriatic acrimony; and have recommended a more sparing use thereof; fearful of some ill consequence from a more plentiful use, for the reasons there recited. But I have since learnt from repeated experience, that the human body easily bears a plentiful use of lime water, and indeed though continued a long while together, with vast relief of the tortures of the stone. The celebrated De Haen relates a remarkable case of a shoemaker (*r*) who had been afflicted with the stone above seven years. This man beginning with a few ounces, and increasing the quantity by degrees, at length drank every day two quarts of lime water and as much milk, together with an ounce of soap; so that in the space of seven months he had taken seventeen pounds of soap, and seven hundred and fifty quarts of lime water, and the same quantity of milk. After having used these medicines about three months, his pains entirely went off, he could easily retain his urine, and though he left off taking them con-

(*q*) Ibid. pag. 249. (*r*) Ratio Medendi, part. ii. p. 206.
stantly,

stantly, and, being dismissed from the hospital, eat plentifully of salted meats, and high seasoned things, of which he was fond, he continued in perfect health. Yet the stone was felt upon introducing a catheter, and the urine was mucous : when on account of a phlethora a quantity of blood was taken from this person, it had every good appearance ; whence it may justly be concluded that these remedies may be taken with the utmost safety. I advised a captain in the army, a person in years, to drink lime water with milk only, without any soap, and he found himself entirely relieved from the tortures of the stone in the bladder (*s*). To ease the symptoms is certainly a vast matter ; especially where lithotomy cannot take place ; which circumstance is more largely expatiated on in the place just cited.

I have since met with patients who loathed milk ; such have drank the lime water by itself, and indeed with an excellent effect, namely, a remarkable alleviation of all the complaints, even in those who had every symptom of a stone lodged in the kidney. Perhaps a greater effect might be expected from lime water, in dissolving the stone, if drank without milk.

Macbride (*t*) deduces the efficacy of lime water on the stone, chiefly from the power with which the lime contained in lime water attracts to itself the fixed air, which constitutes such a considerable part of the bulk of the whole stone ; now he has discovered from experiments, that if a third part of milk is added to the lime water, it destroys a great part of its efficacy ; as the milk saturates the lime with its own fixed air, and precipitates the lime from the lime water, and thus

(*s*) Ibid. Part. iii. pag. 172. (*t*) Experimental Essays, pag. 253.

renders it inert, and incapable of lessening the cohesion of the stone. Moreover he takes notice that the celebrated Alston has observed, that almost every ingredient which is usually added to lime water, more or less weakens its efficacy, and therefore has recommended the drinking of it alone, without any mixture whatever.

He also thinks, this is the reason (*u*) why frequently lime water, when drank, produces no remarkable effect, with respect to the dissolution of the stone. For in the *primæ viæ* it meets with the vapor of the fermenting aliment, which, as has been said before, precipitates the lime from lime water. Nay if the lime water should arrive at the bladder possessed of its whole virtues, it would there meet with the urine, which contains fixed air, by which at least part of the lime water would be saturated, and thus its lithontriptic virtue be diminished. Hence also he deduces the quantity of earthy matter, that usually subsides from the urine of those who drink lime water, and which he imagines is precipitated, at least the greatest part thereof, from the lime water.

For the expectations formed from lithontriptics are chiefly founded on this circumstance; that the urine, impregnated with their virtues, will act upon the stone contained in the bladder, which is as it were macerated in such urine: and therefore the patient is advised to endeavour to retain his water a great while; that is as long as he possibly can do it without great uneasiness (*w*).

From these circumstances it appears, that patients often obtain great relief from the use of these medicines, and likewise that there is reason to expect that the stone will be lessened in its size thereby.

(*u*) Ibid. p. 234. (*w*) Medical Essays, vol. vi. p. 251.

But as all lithontriptics taken internally, are justly supposed to lose some part of their virtues, as well in the first passages, as while they circulate with the fluids of the body, before they can arrive with the urine at the bladder, and act upon the stone; hence physicians have properly enough began to think of injecting lithontriptic remedies into the bladder itself, that is such as there was reason to imagine, might be borne in the bladder without injuring its structure.

The antient physicians used to inject liquors into the bladder; not indeed in hopes of dissolving the stone, but with a view of detarging the bladder when ulcerated (*x*). The method of introducing a catheter into the bladder is very well described by Ægineta. They used a peculiar artifice to draw off the urine in an ischury, with a catheter: for they tied a thread round a little bit of wool, and with a sharp reed passed the thread through the pipe of the catheter, till it projected beyond the other end; they then pulled the thread, till the wool fixed itself close to the orifice at the end of the catheter: the wool could then be commodiously fitted to this orifice so as perfectly to close it up. Whatever wool projected beyond the even surface of the catheter, was cut off with a pair of scissars, that it might not hinder the introduction of the catheter. When the instrument was introduced into the bladder, by drawing the thread, the wool was pulled into the cavity of the catheter, and expanding itself, filled the whole circumference thereof (for wool is elastic), and thus acted as a sucker of a pump, and if further drawn up, the urine followed the sucker, in like manner as we see done in pumps: and this may have its use, where after

(*x*) Aegineta, lib. vi. cap. lix. pag. 90.

a long continued retention of urine, the bladder has lost its contractile power. And that the ancients expected this effect therefrom, is apparent from the text : *secundum hoc, linum catheteri injectum retrahemus, quo urina simul cum lana attracta subsequatur, quemadmodum in syphonibus accidit.*

“ In this manner, we pull up the wool fixed
“ to the end of the catheter, and the urine follows the wool when drawn up, in like manner
“ as any liquid is taken up by a syringe.” Moreover, they tried to throw liquids into the bladder with a syringe; and when this method did not succeed, they introduced a catheter into the bladder, and fixed an ox’s bladder to the other extremity of the bladder, and thus cleansed that organ.

The celebrated Whytt has proposed (y), that during the internal use of the lithontriptics above recommended, in calculous cases, five or more ounces of tepid shell lime water, should be injected into the bladder every day, and the patient directed to retain the injection as long as he can without great pain : but this injection ought to be thrown up immediately after the patient has discharged his urine. Nay this might be done several times a day, unless the repeated introduction of the catheter should prove troublesome and painful : Whence, if a flexible catheter was retained in the bladder, this inconvenience would be avoided, and such an injection might be repeated at pleasure.

But it sometimes happens, that the bladder cannot bear lime water, although rendered more mild by the addition of milk : De Haen has remarked this in the shoemaker just mentioned (z).

(y) Medical Essays, vol. vi. p. 256. (z) Ratio Medendi, part ii. p. 226.

For though he took lithontriptics internally with great resolution, yet he could not bear injections of lime water and milk, which were attempted to be thrown up once or twice a day, with an instrument contrived for this purpose. *Injectiones, quacumque arte, prudentia, mutatione, aut copiae, aut materiae, administrarentur, ferre non potuit.* “He could not bear injections, however art-
 “ fully or cautiously, or in whatever quanti-
 “ ty administered, or of whatever ingredients
 “ composed.”

Whence Whytt seems (a) perfectly right in his opinion, that it is proper to let the patient drink lime water some weeks before he uses it by way of injection, in order to mitigate his pains: for thus the internal surface of the bladder, that before was too tender, will more easily bear the injection, and retain it longer when injected, so that it may have time to act upon the surface of the stone.

Yet as the stomach and bowels can easily bear lime water; nay the eye bears lime water dropped into it without any great inconvenience; and surgeons foment ulcers difficult of cure with lime water, without increasing the pain, it does not seem as if lime water was sufficiently acrimonious to injure the bladder. Nevertheless, if the internal surface of the bladder should be so tender as to be greatly irritated by lime water, in this case, a drachm of starch may be dissolved in six or eight ounces of oyster-shell lime water, and just brought to boil over the fire, stirring it all the while; or a quarter part of the yolk of an egg may be mixed in the same quantity of lime water, and then the injection will be attended with less uneasiness; though the lithontriptic virtue

(a) Medical Essays, vol. vi. pag. 256.

of the lime water is not weakened by either of these substances mixed therewith ; as appears from experiments (*b*). The mucilages of gum arabic, and linseeds were also tried ; but they both destroy the virtue of lime water more than the starch or egg.

But as these injections, in order to prove of service, must be frequently repeated, it seems difficult to attempt this by introducing a catheter into the bladder ; for often calculous patients feel great pain, though the catheter is introduced by a skilful and experienced hand : nay I have known many, who having once been searched for the stone with a catheter, would upon no account suffer it to be passed a second time, though some weeks had elapsed. Indeed, as the injection is to be repeated every day at least once or twice, there will be few, especially of the male sex, willing or capable of bearing injections administered in this manner. Whence another method has been devised, by which lime water may be thrown up the urethra into the bladder, with sufficient force to overcome the resistance of the neck of the bladder and its sphincter, without injuring the parts. For thus the repeated introduction of a catheter into the bladder, is avoided. The ingenious William Butter(*c*) has described and given a figure of such an instrument, by which he thinks the injection may be made by the patient himself, without any other assistance ; which certainly would be very convenient. The lime water ought to be pressed, with sufficient force to overcome the resistance of the sphincter of the bladder, through a pipe introduced pretty far up the urethra, lest the injected

(*b*) Ibid. pag. 259. (*c*) A method of cure for the stone, chiefly by injections,

liquor should regurgitate. To effect this, the lime water is poured into a sheep's bladder, the neck of which, by means of two tubes, the second of which has a moveable cock, is fitted in such a manner to the tube, placed in the urethra, that the bladder being pressed, the liquor contained therein passes through the tube with considerable force, which however can be easily lessened at pleasure. This bladder is placed in an hollow wooden machine, which in its external figure resembles a pair of bellows, the upper part of which being pressed down, the bladder is compressed, and the contained liquor is squeezed out. As it is easier to add something to an invention, than discover any thing new, it seems probable that this machine may be rendered more simple. The author has carefully noted down all the precautions necessary to be taken in using this instrument. And likewise describes the case of a patient (*d*) who took soap and lime water; and at the same time, by means of this machine, had four or five ounces of lime water injected into the bladder, twice every day. This patient had been afflicted with the stone above four years, and upon his being searched, a stone was felt with the catheter which seemed large; after he had been treated in the above manner the space of three months, upon searching a second time, no remains of the stone could be felt in the bladder. He still felt some pain, though seldom, and but slight; and now and then some obstruction in making water. He however returned home, but was directed to persist in the same method, till these symptoms should entirely disappear.

The celebrated Hales has made many other experiments concerning the dissolution of the

(*d*) Ibid. page 61.

stone (*e*), by mixing acid liquors with alkaline salts, and immersing therein human stones, while in a state of effervescence. For he had conceived hopes, that by these sudden shocks of effervescing liquors, the fixed air, that is contained in such great quantity in the stone, might be separated, rendered elastic, and by this means the union of the constituent parts of the stone be dissolved. Upon repeating this experiment several times, he found that some stones emitted a great many air bubbles, and likewise became friable; but the experiment did not succeed with hard stones. Moreover the fluid produced by the union of the acid and alkali, did not in the least act upon stones infused therein. Hales indeed acknowledges (*f*), that these experiments no ways induced him to try the practice on the human body; as the application of effervescing liquors to the stone must be repeated very frequently, before any considerable effect is observed, and the acid and alkaline liquors ought to be injected separately, that the effervescence might be made in the bladder itself: but both these liquors seem too sharp to be borne by the bladder without injury.

From all these circumstances it may be concluded, that lime water either by itself, or together with Alicant soap, may be safely taken inwardly. Nor can it be denied, but that it has done service to many, so as greatly to relieve the tortures of the stone, nay sometimes it has entirely removed the symptoms, though the stone still remained in the bladder. Nevertheless, many recent observations seem to prove that lime water really possesses a lithontriptic power, at least if the stone is not extremely hard: which effect might

(*e*) Hæmastatics on the animal calculus, page 191, etc.

(*f*) Ibid. page 209.

especially be expected, provided lime water was properly injected into the bladder; for then by the heat of the human body, it would be digested, in its full virtue, with the stone, several hours together every day, and by this means there would be great hopes of so lessening the size of the stone, or of rendering it so brittle, that by degrees its whole substance might be voided with the urine, and thus the patient entirely freed from his disorder. Besides, it seems highly probable, that the use of lime water may prevent the separation of fresh calculous elementary principles from the urine, which might increase the size of the stone: the celebrated Whytt has proved this by ingenious experiments (g); namely, that not only the separation of these particles from the urine is prevented by a mixture of lime water; but also, that in urine left to itself for forty-eight hours, the calculous concretion formed round the sides and bottom of the vessel, was readily dissolved by pouring thereon lime water; and although this vessel was left unmoved for thirty hours after, no calculous incrustation grew any more to the sides or bottom thereof.

But if no fresh calculous matter is added to the stone in the bladder, its surface must by degrees be worn away by the urine, and the pressure of the contracted bladder when the urine is voided, as well as by its rotation in the cavity of the bladder, when it is successively filled with urine, and the patient by walking, or from any other cause moves his body. It is true indeed, that the sides of the bladder are equally wasted by the stone, the membranes however remain whole; which also are sometimes thickened in calculous cases, as has been be-

(g) Medical Essays, vol. v. page 685.

fore observed. But the bladder is a part of the living body, to which the parts wasted away are every day restored by nutrition: the stone is a dead body that cannot be nourished; hence, unless fresh calculous matter be added thereto, it must of consequence gradually diminish in its size.

The extraordinary relief, that calculous patients experience from the use of lime water, as I myself have observed in many cases, and as is attested in those above related, sufficiently authorises the exhibition of this remedy, though it possessed no lithontriptic property. Perhaps there are many such, which indeed alleviate the tortures of the stone, yet do not dissolve the stone. In the preface prefixed by the celebrated Linnæus to his oration on the increase of the habitable earth, which he spoke according to custom in the royal academy of Upsal, on occasion of his taking a further degree, on the 12th of April, 1743, among others, mention is made of *Uva Ursi*, a species of the *Arbutus*, common in Sweden. For some years after, the use of this plant prevailed greatly among the Montpellier physicians; they prescribed half a drachm of the leaves in fine powder, for ten successive days, in chicken broth; in hopes of its wasting away the stone. These leaves are extremely astringent; whence in Sweden they are reckoned one of the principal plants for the purpose of tanning leather. Every body knows that the skins of beasts, in order to fit them for our various uses, require a long maceration; by which they become so soft and flaccid, that they tear from almost the slightest handling. For which reason curriers always use astringent plants, to restore their lost firmness to the skins. In different countries, different plants are used for this purpose, especially such as can be procured at a very low price. And therefore *Uva Ursi*, possessing a very great

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degree

degree of astringency, and being extremely common in Sweden, is there used for dressing of skins.

It was easy to collect a quantity of this plant, as it grows in great plenty on some mountains of Austria, and Styria, during many months of the year wholly buried in snow. The powder of the leaves of this plant was administered to calculous patients, even in a larger dose, often with such remarkable success, that the patients thought themselves entirely freed from the stone, though upon passing the sound, the stone was plainly felt in the bladder; as appears from the experiments made and described by the celebrated De Haen (*b*). Some found relief from their pains soon, some later, which if they were extremely excruciating, were appeased by opiates, during the use of the *Uva Ursi*. However, that the alleviation of the pains is not to be attributed to the opiates solely, appears from hence, that opiates were unnecessary afterwards, though the stone still remained. Moreover, those urines which exhaled a very bad foetid smell, and were so alkalious, that as soon as voided, they would effervesce with acids, and change syrup of violets green, were changed for the better, and became like natural healthy urine; the purulent matter, and viscid heavy mucus, which often are voided with the urine of calculous persons, at length entirely ceased; the stone however still remaining. Nor was this relief only of short continuance, but lasted for several months. Besides, it was observed in some who would no longer take the medicine, that their pains and other symptoms again returned; which however were quickly alleviated, by a repetition of the *Uva Ursi*. That it is of extraordinary service, in ulcerous disorders of the

(*b*). *Ratio medendi* part ii. pag. 192. part. iii. pag. 156.

urinary passages, where there is not the least sign of a stone, I am certain, from repeated proofs, where I used this medicine only, and indeed for a sufficient length of time, without any thing whatever, except a decoction of marshmallow roots, and liquorice, which I directed the patient to drink plentifully of, to dilute and obtund the acrimony of the urine, constantly washing the ulcerated parts.

Whence this remedy deserves commendation; though nothing certain is known with respect to its lithontriptic power.

Helmont extols the liquor that in Spring flows from the birch tree, when its bark is wounded, in such plenty, that from a wounded branch, eight or ten pints will distill in a day, as a most useful remedy for the stone; especially the liquor from the wounded branches, for he thinks this liquor more pure and rich than what exsudes from the wounded trunk; which is quite aqueous, if the bark of the trunk is wounded near the bottom (*i*). He especially expected a great deal from the liquor of the birch tree, as a preservative against the stone, as well as for the relief of the tortures of the stone. *Est ergo liquor ille Betulæ medicamen a natura promissum, per vulnera sollicitatum: adeoque est urgere naturam, ad proferendum balsamum sibi naturalem, quem alias nusquam proferre.* “The liquor of the birch tree is therefore a medicine promised by nature, solicited by wounds: and indeed this is constraining nature to produce a natural balsam, that she otherwise never would have produced.” Concerning this liquor of the Birch tree, Boyle attests, that many calculous persons found great relief thereby: and among others a cousin of his own, who had tried to no pur-

(i) De Lithiasi, cap. viii. pag. 708, 709. § 24.

pose an incredible number of remedies, obtained relief from his tortures, only by the use of the liquor that flows from the wounded Birch tree, as long as he could procure it: Boyle therefore collected a large quantity of this liquor in the spring, and kept it unchanged, by pouring fallad oil over it, to prevent the access of the air, or by impregnating the vessel in which he intended to put the liquor, with the fumes of burnt brimstone, to prevent its fermenting; and by this means obtained his relation a longer continuance of relief from his tortures (*k*). But this liquor does not seem to possess a lithontriptic property; for after the death of this person, who died of another disease, the bladder being opened, a stone was found that weighed some ounces: nor is the least notice taken, that the stone was eroded by this liquor, which had been taken for a long time, and in great quantity. It seems likely, that such remedies prevent the increase of the stone; at least during the time they are taken; it is certain, that they alleviate the torments, and render life more tolerable to the wretched sufferers: indeed this is a great matter. We read in Helmont (*l*), who, delighting in new words, calls the stone Duelech, that he distinguished these two circumstances in the cure of the stone, namely, the prevention of the increase of the stone, and the destruction of the stone already formed. *Siquidem desiderabatur ejusmodi remedium, quod impediret venturam succresscentis Dueleck sobolem, per ipsius lotii preparationem etc. dumtaxat propellendo calculo, laxandisque meatibus urinariis, intentæ fuere scholæ. Itaque in sanatione Lithiasis duplex obvia sollicitudo est. Una nimirum, quæ inclinationem tollit, ac metum recidivæ.*

(*k*) Usefulness of Experimental Philosophy, page 179.
 (*l*) De Lithiasi, cap. vii. § 6. pag. 694.

Altera vero, quæ generatum demoliatur Duelech.

“ Indeed a remedy of this kind was requir-
“ ed, which might prevent the future growth
“ of the stone, by the preparation of the urine,
“ etc. The schools have only been attentive to
“ expel the stone, and relax the urinary passages.
“ Therefore in the cure of the stone a double in-
“ tention is obvious, first, to remove the pre-
“ disposition, and prevent a relapse. Secondly, to
“ destroy the formed stone.” To do either is no
easy matter. For medical history informs us, that
some have been so unfortunate, as to be obliged to
undergo the operation of lithotomy several times,
fresh stones having been repeatedly formed in the
bladder: and to dissolve within the body the
stone already concreted, or to corrode it in such a
manner, that sensibly diminished in its bulk, or
separated into pieces, it may be voided with the
urine, is equally difficult. One menstruum only is
as yet known, that dissolves the human calculus,
namely, spirit of nitre. But spirit of nitre is so
sharp, that it would sooner destroy the bladder
than the stone, if injected therein. If it were to
be taken inwardly, it must be very much diluted,
to be borne by the stomach and intestines; but
then it loses its solvent power, and before it can
arrive at the bladder from the stomach and bow-
els, from its mixture with the different humours of
the body, it may be rendered wholly inert. For
which reasons, physicians in general despair of this
medicine as a lithontriptic.

Pechlin relates (*m*) that there was a French em-
piric in Holland, who boasted of being in posses-
sion of a lithontriptic medicine. He dissolved in
the presence of the spectators an human calculus
in a certain fluid, and presently precipitated it

(*m*) Observat. Physico-Medic. No. 14. pag. 31.

again by the addition of some lixivium, or oil of tartar per deliquium. If the clear fluid was tasted after the precipitation was made, it seemed sufficiently mild. Thus he endeavoured to deceive the public, even before their faces.

But he would not suffer any body to taste the fluid, in which he dissolved the stone, till he had added the oil of tartar, asserting that he was bound by oath, not to reveal the secret. At length it happened, that this hitherto unknown fluid was shewn to the whole college of students, and was found to be acrid. One of the students brought the next day, *spiritum nitri dulcem; in quem cum calculum protinus immitterent, vidimus, eum pari facilitate solvi; deinde etiam, ex liquoris poris oleo tartari evocatum, fundo praecipitari; cumque etiam color et odor spiritus plane non dissimiles accederent, eum ipsum esse judicavimus. Ad quod spectaculum varia obmurmurans plagiarius cum pudore discessit.* “Some
 “ dulcified spirit of nitre, in which when a stone
 “ was infused, we saw it presently dissolved with
 “ the same facility; and afterwards drawn from
 “ the pores of the liquor by oil of tartar, and
 “ precipitated to the bottom of the glass vessel;
 “ and as it also plainly resembled the fluid made
 “ use of by the empiric both in colour and smell,
 “ we judged it to be the very same. At which
 “ sight the impostor murmuring went off with
 “ disgrace.” But even dulcified spirit of nitre could not be borne by the bladder unless diluted with a large quantity of water, and then it would become inert. Which must likewise be the case, if this medicine is given internally, for the same reason.

From what has been hitherto said, it is evident, that no small benefit has sometimes been observed from soap and quicklime, united together
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in different ways, or exhibited apart. But soap contains a quantity of alkaline salt, rendered more acrid by the addition of quicklime, (*n*) to which is conjoined a vegetable or animal oil; and thus soap is made. (*o*) For the soapboilers dilute a fixed fiery alkaline salt prepared with quicklime, in such a quantity of pure warm water, that the lixivium made thereby will sustain a new laid egg. This lixivium or lye is called capital soap lees; a portion of which the soapboiler dilutes with a quantity of water, till a new laid egg sinks to the bottom. An equal quantity of oil is mixed with this weaker lye; and these ingredients are boiled together, the water being evaporated, they begin to unite together. This being done, three times the quantity, with respect to the oil, of capital lees are added; and the whole is boiled together till it becomes a solid hard mass, which is called soap; which if it has an acrid alkaline taste, requires the addition of some more oil; on the contrary if any sign appears that the oil is predominant and not thoroughly united with the salt, a little more of the capital lees is added, which by boiling are so united together, that they become a mass that will bear cutting, perfectly soluble in water, not sharply alkaline to the taste, and which will not liquefy when exposed to the air.

From this composition of soap it appears, that its virtue of dissolving the stone principally depends on the capital lees, which contain an alkaline salt rendered more acrid by quicklime; whence several eminent physicians have thought proper to make trial of experiments with a view to determine the degree of force with which this lixivium acts on the stone. Hartly relates many ex-

(*n*) Boerhaave Chem. tom. ii. p. 60. Process xiii. (*o*) Ibid. Process lxxiii. p. 257.

periments (*p*) which the celebrated Hales made with this lye on two human calculi, one of which was large, and of a light brown colour, the other resembled a mulberry, was of a blackish brown colour, and extremely hard, and when sawed through shone like polished marble. He boiled a piece of the first stone for half an hour in capital soap lees, and it entirely dissolved: while boiling, a great number of bubbles of air arose from the stone, which he justly reckoned one of the most certain signs of a stone's being ready to split to pieces. Nay, by digestion alone, a part of the same stone was dissolved, in a shorter or longer time, according to the degree of heat, and even by a cold digestion the stone was dissolved by the same fluid in the space of three days.

A piece of the harder stone, boiled in the same lixivium, an whole hour, was not indeed dissolved, but its external surface was so softened, that it resembled a kind of stiff mud; and the internal parts were become putrid and brittle. Another piece of the same stone, became putrid and brittle, by being digested with the above lixivium made warm, for the space of seven days. Whence it appears that this remedy intirely dissolved the stone which was of a moderate hardness, and rendered the hardest stone friable. But a lixivium of fixed alkaline salt alone, though of the same specific gravity as the other, and therefore equally saturated, did not affect the pieces of the same stones infused therein.

From these experiments Hartly concludes,
 “ that a lixivium of quicklime and fixed alkaline
 “ salt macerated together, is the most powerful
 “ menstruum to dissolve human calculi, exceed-
 “ ing in an immense degree a lixivium of alka-

“line salt alone, and only excelled by spirit of nitre, so far as is yet known.”

Several experiments are likewise related, (*q*) which prove that the urine is rendered medicinal by this remedy; so that a small quantity may suffice to prevent the accession of fresh calculous elementary principles to the stone from the urine contained in the bladder; if the quantity taken of this lixivium be increased, then also the urine will diminish the stone, which it constantly washes. Moreover it is proved, that lime-water possesses a sufficient degree of lithontriptic power, which is increased in proportion to the strength of the lime, and the lesser quantity of water in which it is quenched. It is usual however, in preparing lime water for this purpose, to add four quarts of water to a pound of quicklime; for lime water of this strength is easily borne by the human body, and may be safely drank in large quantities, as appears from the foregoing observations.

But capital soap lees are very acrimonious; and from this liquor inspissated is prepared the potential caustic used by surgeons, which applied to the skin, destroys it in a short space of time, and makes a gangrenous eschar on the part: whence it is clear, that this cannot be administered except in a limited dose, and diluted with a soft liquor.

The celebrated Hartly, was of opinion, (*r*) that half an ounce of the capital soap lees might be taken in half a pint of cow's milk four times in a day without prejudice. But he ingenuously acknowledges, that there had not been made a sufficient number of experiments concerning these matters, and exhorts the faculty to be strenuous in their endeavours to ascertain this fact by various

(*q*) Ibid. p. 56, &c. (*r*) Ibid. p. 72: —

experiments.

experiments. It appears the safest way, to begin with a small quantity, seeing that the pains are sometimes increased in the beginning of such a cure, as Jurin experienced in his own case (*s*). I lately directed a calculous patient to take a drachm of the capital lees, every morning, diluted with an hundred times the quantity of veal broth, and by degrees to increase the dose in a like proportion: he has since wrote me word, that when he had increased the dose to two drachms, his pains grew more violent, and he voided a great deal of mucus with his urine. Jurin (*t*) by degrees increased his dose so much, that at length he took every day twelve drachms of capital lees; but in like manner diluted with a liquid, which however was scarcely mucilaginous.

Nor does it appear that he found relief, till he had persisted four months in the use of this lixivium (*u*). Towards the fifth month he voided stones; and after having taken it seven months was not yet perfectly cured. Whence the celebrated Whytt preferred the use of lime water; because the patient sooner finds relief from it. The ingenious Macbride relates, (*w*) that a certain physician administered a nostrum which, if taken constantly for several months together, dissolved the stone: the patients were to send their broth every day to the physician, who mixed therein his nostrum; which since appears to have been nothing but the above capital lees.

This remedy is extremely acrid and fiery; hence cannot be taken, unless very much diluted; and therefore it is probable, when it arrives at the bladder with the urine, it may prove quite

(*s*) Medical Essays and Observations, vol. v. p. 736.

(*t*) Macbride's Experimental Essays, p. 235. (*u*) Medical Essays in the place above cited. (*w*) Ibid. viz. Dr. Chittick.

inert; which argument has so often been objected against the boasted virtues of other lithontriptics, and indeed with justice. Mean while it cannot be denied, but that alkaline salts rendered more acrid by the addition of quicklime, still possess a considerable solvent property, though diluted with a large proportion of water. A similar remedy has been already commended at § 1277, where we treated of the dissolving of gouty chalk stones, which is composed of tartar calcined in an earthen vessel, with three times its weight of quicklime. This saline mass is to be dissolved in water, and the filtered liquor, inspissated into a salt; which is afterwards dissolved in such a quantity of water, that the solution, if tasted, occasions no uneasy sensation on the tongue. Yet this solution so much diluted dissolves gouty chalk stones in a few days time. Now if it be considered, that eminent personages in the medical art, have acknowledged a great affinity between calculous concretions, and the lime or chalk that issues from ruptured gouty tophs, it will clearly appear, that we are not to give up all hopes, that similar remedies, though very greatly diluted, are capable of acting on the stone.

It has been observed, that some medicinal springs dissolve human calculi by digestion (x); however the contents of these springs, as is well known, are diluted with a great quantity of water. The Caroline baths, though they encrust the pipes through which they flow, and bodies immersed therein, with an hard stony concretion, yet remarkably diminish the size of the human calculus if macerated in these waters; this Springfield has seen happen to stones of the kidneys, as well as

(x) Villers Analyse des Eaux Miner. de Marimont, p. 143, &c.

those of the bladder (*y*), not only when macerated in the water of the baths, but also when digested in the urine of persons who drank those waters; although the urine of an healthy person who has not drank these or similar waters, increases the human calculus if immersed therein. But these waters had not the same effect on stones of the gall bladder. From hence it is evident, that those persons do not entertain vain hopes, who imagine, that the urine, by means of medicines taken inwardly, may be so changed as to soften and render friable the surface of the stone which it washes, and thus by degrees lessen its bulk, or also render a rugged stone so smooth, as to prove less injurious than before.

Hartly, from the experiments he made, concludes, that even pure water possesses a lithontriptic property (*z*). “ For if a stream of pure
“ water could pass through the kidneys and bladder every day for a sufficient length of time, it
“ would entirely dissolve all stones that might be
“ lodged there.”

But he thinks the encrustating property of healthy urine, which by a fresh apposition of stony particles would increase the bulk of the stone faster than the gliding water could wear it away, ought to be prevented. This he fancies may be obtained, from the use of a lithontriptic medicine prepared from lime and soap. Whence these and other similar medicines act in a two-fold manner; first by hindering the increase of the stone; secondly, by rendering the urine medicinal, so as to enable it to act upon the stone: for he proves by experiments, that his own urine remarkably diminished the bulk of human calcu-

(*y*) De prerogativ. Therm. Carolin. in dissolvendo calculo, &c, Lipsiæ 1756. (*z*) De lithontript. J. Stevens, p. 47.

li immersed therein, while he took these medicines himself. Stack, (a) who with such accuracy examined human calculi and those of other animals, from his own observations concluded, "that urine generating the stone, differs at different times, so as sometimes to generate more, sometimes less stony particles; lastly, that sometimes in different circumstances of the body, it may, from producing the stone, become medicated." He was confirmed in this opinion, from what he heard related by herdsmen, that horned cattle kept the whole winter in stables, and fed on hay, became calculous, and were cured in the spring by being turned out into the green pastures. Moreover he observed in a stone that was voided, whole and externally entire, signs of corrosion on the internal surface of the external coat or layer; which erosion seemed to have been made at a time when the urine was become medicinal; to which afterwards a new layer had accreted, when the urine was in a state of generating the stone.

The celebrated Lobb made use of another method to render the urine medicated, so as to enable it to exert a solvent power on the stone. As the stone contains so large a portion of fixed air, he did not desire a quick solution of the stone, though it were possible to obtain it; fearful lest, its elastic power being suddenly restored to the air before inelastic, a sudden explosion, and other mischiefs might ensue in the human body. Whence he rather chose to effect this matter more slowly, and indeed by such substances as are sufficiently friendly to the constitution, namely aliments. He therefore determined to investigate by experiments, whether, among the meats, drinks,

(a) Letter to Hartley, p. 21.

and fauces, that are commonly made use of by mankind, there might not be some, that possessed a power of dissolving the stone, if applied to the stone out of the human body. If such aliments were discovered by the experiments made, then such were to be used in preference to others; and on the contrary, all the aliments were to be avoided that were observed to increase the bulk or hardness of the stone; as also those which did not act at all upon the stone to which they were applied out of the body; not because these would prove injurious; but because they prevented the use of more beneficial aliments, as the stomach can only receive a fixed quantity of solid and liquid food.

This excellent man was thoroughly sensible that aliments undergo such a change in the human body, that they are divested of their own nature, and receive that of our bodies: nevertheless it is certain, that such substances are eat, as, while they remain in the stomach, change the urine, and indeed pretty quickly. Asparagus, a few grains of turpentine, &c. it is well known, change the smell of the urine in a short space of time: whence it does not seem improbable, that other virtues of meats and drinks may also quickly arrive at the kidneys and bladder; although the sensible qualities of the urine remain unchanged. He essayed a multitude of experiments, and digested human calculi with the decocted or infused juices of the different vegetables, that usually supply the table. Among the principal that act upon the stone, he reckons
“ juice of lemons, rape roots, their expressed
“ juice, and the strong decocted juices of mul-
“ berries, strawberries, vinegar, the juice of el-
“ der-berries, pears, and grapes, honey diluted
“ with water, the juice of asparagus, parsley,
“ milk,

“ milk, chocolate, smallage, cucumbers, the decoctions of leeks and onions, raisins, and figs, sorrel, wood sorrel, decoctions of oats, barley, rice, the juice of oranges, hops, an infusion of tea prepared with boiling water, particularly raisin, and elder wines, and cyder (c).”

But all these substances acted very slowly on the stone, so that not only many days, but also months were required to dissolve the stone, or render it friable enough to be crumbled to pieces with a slight force. Whence the urine ought a long while to be medicated, by a plentiful on such aliments, to produce any notable effect. The celebrated Hales found (d) that onions beat into a pulp, and also their juice diluted with water, acted very powerfully on the stone; and thence concluded, that from the use of them, if the entire destruction of the stone was not procured, at least its further increase would be prevented. Another reason why the effect of these remedies must be slow, is because they must be mixed with the urine that flows over the stone. But Hales has observed human calculi (e) dissolved by digestion in simple water continued for several days, and moreover wholly covered over with a white mucus; but when only a fortieth part of healthy urine was added to the water in which the calculi were macerated, the dissolution proceeded far less successfully; although the vessel, that contained the calculi and water mixed with urine, was placed in hot dung; of which circumstance mention has already been made at § 1425.

(c) Lobb on the stone, pag. 1, to 204. (d) Hæmastatics on the animal calculus, Exper. vii. pag. 215. (e) Ibid. Exper. vii. pag. 216.

S E C T. MCCCCXXIX.

WHEN the stone has fallen into the narrow part of the pelvis, it requires the same means, (laid down from 1425, to 1428) and especially clysters, fomentations and bleeding.

It has already been observed, that the pelvis of the kidneys, grows narrower towards the inferior part, and gradually becomes a part of the ureter; it therefore readily appears, that a large stone, which sticks in the cavity of the pelvis, must meet with obstruction when it arrives at the lower and narrowest part of the pelvis, which is the beginning of the ureter: the same will hold true, if several smaller stones should remain impacted in the same narrow passages. But if this should happen in both kidneys at the same time, *interclusa urina, distentisque locis, paucis diebus superstites ægri moriuntur* (f). “The urine being shut in, and the parts distended, the patients die within a few days.” Whence it is plain, that the same remedies are required in this case, as have been recommended, in the sections enumerated in the text, for the expulsion of stones from the kidneys. Clysters also are particularly serviceable in this case; because thereby the hard excrement that distends the gut colon, which lies very near the kidneys, is evacuated, and this intestine prevented from compressing the pelvis, and beginning of the ureter. At the same time also, if the colon, after the excrements are voided, be

(f) Aretæi, Lib. ii. De causis et signis morbor. diurn. cap. iii. pag. 53.

filled with an emollient, oleaginous, warm liquor, it affords a mild comfortable fomentation to all the neighbouring parts. For the same reason, similar fomentations or cataplasms are externally applied to the loins, that all the parts internal as well as external, may be relaxed, and easily give way, and the violent pains be alleviated. For although the cause of the disorder is fixed in the pelvis of the kidneys, yet the intestines and other parts are affected. Therefore, as has been said before, colicky pains sometimes cannot without difficulty be distinguished from a fit of the stone. Whence Aretæus (g), where he describes the symptoms that ensue in consequence of a large stone's being impacted in the concave part of the kidney, says : *Törmina dolores inferunt gravia, perseverantia : intestinum enim sinuosum est. Quumque exundat urina, et distentiones crescunt, ad mejendum, ut in partus doloribus, proritantur. Flatuosi sunt, sed flatus excerni nequeunt.* “ The pains bring on severe constant gripes : for the intestine is crooked, and hath many folds. And when the urine accumulates, and the distension increases, they have a perpetual inclination to make water, as in labour pains. They are full of wind, but cannot break wind.” As soon as the stone has fallen from the ureter into the bladder, *lotium aquosum uberius effunditur : alvus dejicit : flatus inde exhalant : extensus stomachus est : ructus eduntur : a prioribus malis quies datur.* “ A pale coloured urine is discharged in great plenty : the patient goes to stool, and breaks wind downwards : the stomach is distended, and the patient breaks wind upwards : a truce is obtained from the former evils.”

(g) Ibid. pag. 53.

From which it evidently appears, that the stomach and bowells are affected, when a stone is fixed in the narrow part of the pelvis.

Phlebotomy then is especially proper, that the vessels collapsing, the distended parts may be relaxed, and the inflammation to be apprehended in this case prevented, or cured if it has already made its appearance.

S E C T. MCCCCXXX.

TH A T the stone has slipped through the ureters into the bladder, is known from a preceeding nephritic fit, from the pain being afterwards felt throughout the tract of the ureter, from the ceasing of both with the signs of. (1423.)

It is principally to be hoped, that the stone having entered the ureter, may pass through its whole canal quite into the bladder, and afterwards be voided with the urine. But it sometimes happens, that the stone is obstructed in this course, and there is reason to be afraid lest the urine stagnating in the obstructed or at least partly obstructed passage, the stone should be increased in size; and thus be rendered incapable of passing further, whence forthwith a total obstruction of the ureter ensues. Tulpius relates such a case, (*b*) and many such have been already mentioned. Therefore every thing is to be tried to promote the descent of the stone, when it has entered the cavity of the ureter. Aetius says,

(*b*) Observat. Medic. Lib. ii. Observ. 45. pag. 171.

(i) treating of the cure of the stone in the kidneys ; *solvit et nonnunquam calculos insistentes cucurbitula levis ; ac optimum fuerit, si super inflammationem scarifices.* “ Sometimes also a small cupping glass loosens stones that are fixed ; and “ to scarify the inflamed part is a very good “ method.” Galen (k) after having recommended the most emollient fomentations, clysters etc. constantly renewed in order to relax the parts ; *immoderata namque emollitio et laxatio virium robur exsolvit, qua demulcetur omnis dolor, perfecteque curatur.* “ For immoderate mollifying and relaxation weakens the strength, whereby all pain is “ asswaged, and perfectly cured,” afterwards says ; *sed cucurbitulae post haec quoque juvant, quae saepe celeriter adeo calculum transferunt, ut subitam levationem advebant, calculo in ampliorem locum translato. Quapropter supra a renibus initium faciendum est, procedendumque ad inguina per obliquum illum situm, quo loco frequenter dolores incedunt. Satius autem est, dictis (fomentis) partes prius calefacere, deinde ita cucurbitulas admovere. Quandoquidem interdum magnus inventus lapis vehementer incuneatur, qui, quum vehementia trahitur, nonnunquam periculum quoque doloribus accersit.* “ But after these, cupping glasses also are of service, which often “ so quickly remove the stone, that they afford “ instant relief, the stone being conveyed into “ a wider place. Wherefore, begin to apply them “ first above from the kidneys, and proceed “ obliquely to the groins, in which part the pains “ frequently come. But it is better, first to “ warm the parts with the aforesaid fomentations, then afterwards to apply the cupping

(i) De curat. Morbor. diuturn. Lib. ii. cap. iii. pag. 130.

(k) De affect. ren. diagnof. et curat. cap. iv. Chart. tom. x. pag. 534, 535.

“ glasses as above directed. Because sometimes
 “ a large stone is found wedged in, which, when
 “ forcibly drawn, sometimes also proves dangerous
 “ from the pain it occasions.” Aetius recommends the same method, (1) where after the use of the most emollient remedies, the pains are somewhat asswaged, and no inflammation forbids their application. For every body knows, that the part of the body, on which a cupping glass is fixed, instantly swells and grows red, from the diminution of the pressure of the air on the part. Hence all the vessels being more replete, become turgid; so that an inflammation also ensues, if the cupping glass is left on the part too long. Whence the advice of Aetius seems prudent, not to try this remedy while there are signs of inflammation.

Mauricius Cordæus Rhemus wrote a commentary on the first book of Hippocrates the Coan, *concerning women*; and there relates, that he saw in lower Germany a Spanish physician, *cui valde frequens, ex renum calculo, et gravis quidem, dolor fuit. Quo quoties urgebatur, cucurbitulas admoveri secundum ureteris ductum imperabat ipse sibi, ducto primum a parte dolori proxima exordio, deinde iisdem remotis, identidemque deorsum gradatim toties repositis, ut tandem longe diuturniorem ferret ipse ad imum ventrem, in quo vesica jacet, quam ubi vis.*

“ Who being subject to very frequent severe fits
 “ of the stone in the kidneys, whenever he was
 “ seized therewith, directed cupping glasses to
 “ be applied to himself according to the course
 “ of the ureter, beginning first at the part nearest to the pain, and afterwards the same being
 “ removed, were at sundry times gradually fixed
 “ on again, so often up and down, that at

(1) Sermone undecimo, cap. v pag. 256.

“ length he bore a cupping glass far longer on
 “ the lowest part of the belly, where the bladder
 “ is situated, than any where else.” (m) This
 physician declared that the above method had
 succeeded in his own, and in many other cases:
 Cordæus adds, *votoque respondisse alias, id sane*
nobis visum fuit. Cujus et periculum facere sine peri-
culo cuique licet. “ And truly I myself have
 “ been an eye witness to its success elsewhere. And
 “ every one may try it without danger.” More-
 over Beverwyck (n) asserts, that he had often made
 trial of the application of cupping glasses the
 whole length of the ureter, and found them of
 great service.

The cupping glasses at present in use, are very
 easily applied, a small syringe being fixed to the
 glass by means of a screw; this method possesses
 this peculiar advantage, that the air may at plea-
 sure, and gradually be extracted from the cavity
 of the glass, and when it is necessary to re-
 move the cupping glass, the air may be admitted
 by lifting up the valve; and thus the glass be in-
 stantly taken off, which in the old way could not
 often be done without great difficulty, when the
 cupping glasses were fixed by means of air rarefied
 by fire.

When a stone large in size, or rugged in its
 shape, passes through the ureter, it is no ways
 strange that a pain is felt successively through the
 whole length of the ureter; so that sometimes the
 patient can point out the place with his finger,
 where the stone sticks. But if the stone passes
 from the pelvis of the kidney into the ureter,
 then commonly greater troubles ensue; as Are-

(m) Comment. v. cap. v. Israel. Spachii Gynaec. pag. 653.
 (n) Steenstuck, cap. xi. pag. 168.

tæus prudently instructs us; (o) *si in ureterem lapis inciderit, concussio corporis sit ut a rigore, calculi progressus sentitur, cum violenta contentione.*

“ If the stone passes into the ureter, it causes a “ shaking of the body like the cold fit of an “ ague, and the progress of the stone is felt, with “ violent strainings.” In the text it is wrote ξυνῶ ὁμοιότης; but Petit would rather have it read ξὺν τῶν Βλαίω. And by this alteration seems to have amended the text happily enough.

When the stone, having passed through the whole canal of the ureter, has slipped into the cavity of the bladder, all the symptoms cease, *ita, ut ne per somnium quidem dolorem sensisse videantur* (p), “ So that the patients seem not even to have “ dreamed of pain.” This sudden cessation of pain is justly esteemed a sign of a stone’s having passed into the cavity of the bladder. However it sometimes happens, that the patient still feels for some days a certain slight uneasiness through the course of the ureter; but this symptom is usually so trifling, if compared with the preceeding tortures that the unhappy patient has suffered, that he scarcely complains of it.

It sometimes happens, that after the signs of a stone moved from the kidney into the ureter, nothing is voided with the urine; because the stone has remained in the ureter, and has not slipped into the bladder. In such cases it either continues there and grows larger, or after a preceeding inflammation a suppuration ensues, whereby sometimes new passages are formed, through which the stone finds an exit. If the first happens, the place where the stone is lodged, becomes cal-

(o) De causis et signis Morbor. diuturn. Lib. ii. cap. iii. pag. 53. (p) Idem, de curat. Morbor. Acut. Lib. ii. cap. viii. pag. 110.

lous, and in the room of pain, a sense of weight is perceived; the stone encreasing in bulk, the ureter is gradually distended; and sometimes stones of a large size have been found in the ureters after death; as appears from many observations, several of which have been already mentioned. If the second, the part having suppurated, the stone will find a passage, and at length be voided, often at a very distant place, as it is gradually protruded, through the cellular substance in which the ureters are placed behind the peritonæum, by the motion of the body, and action of the adjacent muscles.

A large tumour was formed in the groin of a man, who had long been afflicted with a violent pain in his loins and side, which after having remained a considerable time, at length burst, and in a few days after, together with the purulent matter, an heap of stones was discharged of various sizes, so that the largest was equal in bulk to the joint of a finger, the smallest, was about as big as a pea. They were placed together lengthways, as appeared from the first stone's having an hollow depression resembling a faucer, which a projecting eminence in the second, perfectly fitted, like a joint; in the other extremity of the second stone was a like cavity that received a similar protuberance of the third stone, and so on in like manner to the very last and smallest stone. Whence it seems extremely probable, that these stones, having been lodged in the ureter, could not make their way into the bladder; and afterwards, the part suppurating, had found a passage through which they were discharged. However, the patient by degrees recovered from so grievous a disorder. (q) An-

(q) Denys over den Steen der Nieren-Blaazee. c. 1. p. 22, etc.
other

other man, who had the signs of a stone in his left kidney, was attacked with a pain from his groin to his knee, that lasted an whole year; at length a tumour ensued in the internal part of the thigh about three inches above the knee, which by degrees encreased in size, till it grew as big as a man's double fist; in the very middle of the most prominent part of the tumour, there appeared a red spot the size of a Roman penny. Upon opening the tumour, a large quantity of a whitish thin fluid mixed with matter issued out, both extremely foetid; and moreover an hard body was felt with the probe, large and smooth: the orifice of the abscess being dilated, a large, hard, smooth stone was extracted. For some days after the stone was extracted, the foetidness of the purulent matter increased, but by degrees abated. This patient perfectly recovered (*r*). Many other cases of the same kind are related in medical history, which teach us that stones immoveably fixed in the ureters, have been discharged through suppuration (*s*). I saw in an apothecary, who had frequently voided stones after very severe nephritic fits, a fresh paroxysm come on, and yet no stone voided. The pain indeed abated by degrees; but yet left its traces a long while about the middle of the left ureter. Being fearful lest the stone remaining in the bladder, should increase in size, he tried various means to expel it. Some months after, a painful tumour made its appearance on the side of the abdomen, about four fingers breadth from the navel, which suppurating and bursting, a small but rugged stone was discharged,

(*r*) Ibid. pag. 27, and the following pages. (*s*) Stalpart. Vander Wiel. observat. etc. tom. i. pag. 376, and the following pages.

exactly like those which he had before, at different times, voided by the urinary passage.

But it seems worth notice, that if the pain suddenly ceases, after the signs here enumerated, it may justly be supposed, that a stone has just passed through the ureter, and is lodged in the bladder: though the signs mentioned at § 1423. which prove that a stone is contained in the bladder, do not immediately ensue: for these only make their appearance when such a stone has increased in its bulk.

S E C T. MCCCCXXXI.

TH E N it is requisite to expel it directly, lest the same growing larger, should occasion greater mischiefs.

It has already been fully demonstrated at § 1414, that any body whatever incapable of being dissolved, if lodged any where, may afford a basis, to which a stony substance may accrete; but this is chiefly to be apprehended in those places, which are washed by the urine, or in which the urine remains collected a considerable time, as in the bladder. It was there likewise proved, that the elementary principles of the stone, which are always contained in urine, even in the most healthy, adhere to a stone already formed more readily than to any other substance. Whence it so often happens, that a small renal stone is lodged in the middle of a large stone, as a nucleus, which afforded a basis to the larger stone by degrees formed around it.

Hence the reason is evident, why the expulsion of a stone is immediately to be attempted, as soon as the symptoms inform us, a stone has
passed

passed through the ureter into the cavity of the bladder: for the longer it may remain there, the more difficult will the extraction thereof prove.

It frequently happens, that patients rejoiced at this sudden cessation of their tortures, become refractory, thinking they have nothing more to apprehend. Such persons are to be strictly warned of all the mischiefs that will certainly ensue, if they neglect the immediate expulsion of the stone; and it behoves the physician equally with the lithotomist, to be certain in like cases, that no calculous substance is left behind in the bladder. For sometimes several stones descend at the same time from the kidneys into the bladder, which ought all to be expelled. We know indeed, after one stone has been voided, that others are still left behind, if after repeated nephritic fits, one stone only is voided. Besides, when such stones are small, they often slip into the neck of the bladder, which they irritate, and cause a strangury, nay sometimes a total suppression of urine, till they are removed from that part. The method of promoting and assisting the passage of a stone from the bladder through the urethra, will be laid down in the following paragraph.

S E C T. MCCCCXXXII.

THIS is effected nearly by the same means as directed from (1425 to 1428), but topically applied to the very part; by oleaginous baths, and the like clysters, injecting of oil into the urinary passage,

passage, and frictions of the part to encrease the elasticity of its fibres.

All those things which have been recommended in the sections above cited, to lubricate, relax, and open the urinary passages, and increase the quantity of mild urine, likewise take place here. Stimulating diuretics are hardly ever proper in this case; but soft diluent aqueous liquors prove a most excellent diuretic. Bodily exercise may safely be used, when a small stone can roll about in the cavity of the bladder without injury, for it will occasion no mischief, unless it enters the orifice of the bladder, a desirable circumstance in the present case: hence baths, and fomentations are applied to the perinæum; it is rubbed with oleaginous and emollient liniments; and an oily clyster is frequently injected, but in a small quantity only at once, that it may remain the longer in the gut rectum, and thereby relax the adjacent neck of the bladder; a little oil thrown up the urethra with a syringe, before the urine is evacuated, will also be of service; but it must be injected very gently; because it is not necessary, that it should reach the bladder, but only anoint the whole surface of the urethra, and render it slippery.

It is a known fact, that if a person retains his urine a long while, it is discharged more forcibly, and in a much thicker stream; whence it appears, that the orifice of the bladder is suddenly and greatly distended, and thereby a wider passage made for the expulsion of the stone.

For it is to be remarked, that the stone is almost always expelled from the bladder, during the first violence of the stream of urine, not towards the end of making water: the truth of this

this observation I have learnt from the reports of patients, and have twice been an eye witness to the fact myself! Having previously prescribed large quantities of marshmallow, and liquorice tea, that the urine being rendered aqueous and mild, might be more easily retained; I injected oil into the urethra; I then directed the patient, to run briskly about the room; and when he could no longer hold his water, there being placed in readiness a large basin, he made water in it freely, and with great force; the very moment he began to discharge his urine in a full stream, I with pleasure heard the noise of a stone dashing against the bottom of the basin: nor was the stone very small, being the size of a cherry stone, though rather of a more oblong shape. Aetius (*t*) made use of the same artifice when the stone indeed forced its way out of the bladder, but stuck fast in the middle of the urethra: for he says; *Decoctum quoddam ex prædictis urinam ducentibus plurimum exhibendum est, jubendusque aeger, ut multam urinam congreget, eamque postea emingat, ac diligentius expellat: ita enim detractus lapis celeriter excidere consuevit.* “A decoction prepared
 “ from some of the aforesaid diuretics, is to be
 “ plentifully drank, and the patient is to be or-
 “ dered to hold his urine as long as possible, and
 “ discharge it afterwards as forcibly as he can:
 “ for by this means the stone being withdrawn, is
 “ usually soon voided.”

Does a particular posture of the body favour the exclusion of the stone through the urethra? The celebrated de La Hire (*u*) relates, that a man seized with a violent nephritic fit, while sitting in a chair, bent his body forwards, to

(*t*) Sermone undecimo, cap. v. pag. 257.
 Royale des Sciences, 1701. pag. 65.

(*u*) Academie

write on the ground, by way of diverting himself: in this posture he voided a stone the size of an olive. From his example, another person afflicted with the same complaints, tried the same thing, and with equal success. The ingenious Mery remarks, that in this position of the body, the sides of the bladder approach each other very nearly; whence the cavity of the bladder being lessened, the urine falls out with great force, and brings away with it the stone, in was equal to the cavity of the urethra, a little dilated.

S E C T. MCCCCXXXIII.

THEN the several symptoms ought to be relieved, as they imitate, or have an affinity with this, or any other particular disease.

It is true indeed, that the cause of the disorder being removed, namely the stone, the disease itself is cured: but this is frequently a matter of difficulty, nay sometimes it is impossible to be done: indeed frequently the stone, before it can be brought away, has injured the bladder, excoriated the neck thereof, etc. whence inflammations, suppurations, and many other bad consequences may ensue, that require a particular method of cure; as is obvious.

S E C T. MCCCCXXXIV.

IF the stone is immoveably fixed in the urethra, injections, fomentations, suction, an instrument like an earpicker, gentle

gentle pressure on the part, or even an incision therein, are requisite, or a puncture in the perinæum.

Although stones forced from the bladder into the urethra, are oftener voided with the urine, yet sometimes, when they are large or rugged, they occasion great pain while in their passage, or are immoveably fixed therein, not without danger of a suppression of urine, unless they can be removed from the place where they are lodged. Whence Aretæus justly observes, after treating of renal stones that have fallen down into the bladder (w): *Secunda porro calamitas est, quum per colem calculus transmittitur: nam si amplior sit, quam urethra capere possit, in eo multum temporis haeret, atque vesica multitudine urinae completur, tumque ejus majore cum dolore suppressio fit.* “Further-
 “ more the second misfortune is, when a stone
 “ is forced into the urinary passage: for if it
 “ be larger than the canal of the urethra, it
 “ sticks therein a considerable time, and the blad-
 “ der becomes distended with urine, and then a
 “ suppression of urine with great pain ensues.”
 He makes not the least mention of the female sex, with respect to these complaints; because in women the urethra is much shorter, straighter, and wider; hence the stone more easily passes through, and if it should by chance remain immoveably fixed in the urethra, it might be pushed back into the cavity of the bladder, in order to make a passage for the urine; which it would be far more difficult to effect in men, as the urethra in them is longer, and crooked in its course. A

(w) De causis et signis morbor. diuturn. lib. ii. cap. iii. pag. 53.

stone therefore may lodge in any part of the urethra, from the neck of the bladder quite up to its extreme orifice in the glans penis. A youth eighteen years of age, had almost from his infancy a hard tumour about the root of the yard; which gradually encreasing, at last produced a total obstruction of the urethra; the urine being evacuated with pain and inconvenience through a small hole excavated in the very substance of the stone: afterwards, the integuments suppurating underneath the root of the yard, a new passage was formed for the urine, which then, issued partly through the urinary passage, partly through the aperture of the ulcer. A dextrous surgeon, *facta subtus in penè circa radicem oblonga incisione, scrotum quoque ex parte attingente, calculum oblongum, sinuose pervium, ovi columbini magnitudinem, pollicisque crassitiem, longe superantem, et uncie mediæ pondus æquantem, callosaque membrana undique cinctum, feliciter extraxit* (x). “ Having made an
 “ incision through the under part of the penis
 “ near its root, that partly reached into the scro-
 “ tum, happily extracted an oblong stone as
 “ large as a pigeon’s egg, and above a thumb’s
 “ breadth in thickness, perforated with a sinus,
 “ entirely covered over with a callous membrane,
 “ and that weighed half an ounce.” Segerus wrote an account of this case to Bartholine, who afterwards in his Epistolary Replies, collected a number of observations that show that stones have been sometimes found in every part of the urethra, which stopped up its canal (y).

Stones sometimes, after having cleared the whole length of the urethra, continue immoveably fixed towards the extremity of the urethra, in the glans

(x) Thom. Bartholine Epist. Medicin. Cent. iv. Epist. v. pag. 21, 22. (y) Ibid. Epist. vi. pag. 25.

penis. For the cavity of the urethra is larger towards the nut, but then its sides are mutually flattened together, and form the orifice of the urethra oblong, like a chink, and much less than the cavity of the urethra. I saw in a boy seven years of age, a stone, one of the ends of which projected beyond the orifice of the urethra, in such a manner, that it might be laid hold of with a pair of forceps, but could not be extracted without lacerating the parts; upon which account I advised the surgeon to make it a passage by a small incision; which being accordingly done, a pretty hard stone, variegated with black spots harder than the stone itself, was voided. The wound healed in a very short time.

It also happens, where the prepuce is too narrow, that the urine can only be voided by drops; whence a stoppage is caused between the nut of the yard and the foreskin; and thus an opportunity is offered for calculous concretions to be formed there, or small stones, or nephritic sand that are voided from the urethra, which being retained from the narrowness of the prepuce, may by degrees increase in size. The most renowned Littre saw an instance of this kind (z) in a boy three years of age, in whom the orifice of the prepuce was so straight that it would scarcely admit the point of a very small probe. As a gangrene threatened the part, and the unhappy child, notwithstanding its utmost efforts, could hardly force out his urine by drops, the prepuce was divided laterally, and the part which covered the nut of the yard afterwards cut off; an incredible quantity of stones of various sizes, with a little urine issued forth; the least were equal in size to the head of a very small pin, the largest were as big as

(z) Academie des Sciences 1706. pag. 30.

pease, of a greyish colour, smooth, and by a slight blow divided into lesser masses almost round. It seems likely, that these stones, were concremented from urine retained under the prepuce; as the child afterwards voided no stones. The wound was perfectly cured in the space of three weeks. It will be worth while, to consider the means that have been used to extract stones immoveably fixed in the urethra; that is, in men; for we shall hereafter at § 1438, speak of those that are usually tried in the female sex.

Injectiōns, Fomentations.] The urethra when irritated, especially by a rugged stone, contracts, and thus the passage is rendered still narrower; in the same manner, as has been shewn before, the ureters are when so affected from the passage of renal stones. Whence injections prepared of the most emollient medicines, similar fomentations, and cataplasms are recommended. Water long beat up with oil, if injected milk-warm, very greatly softens and lubricates. The preceeding steps having been taken, the urethra is gently compressed with the finger behind the place where the stone is lodged, in hopes that the stone may be gradually moved forward through the cavity of the urethra, thus previously rendered lubricous.

Suction.] Tulpius extols this as the safest method (*a*), But by suction the air is extracted from the cavity of the urethra; which therefore will be closed from the pressure of the incumbent atmosphere, and thus the passage rather rendered narrower. If the stone should so compleatly stop up the passage, that not even air can pass beyond it, then, the air, which lies between the stone and the orifice of the urethra, being extracted by suction, the air that is situated behind the stone

(*a*) Observat. Medic. lib. iii. cap. viii. pag. 195.

and the bladder, being suddenly expanded, might perhaps force the stone forwards, and overcome the resistance of the collapsed sides of the urethra before the stone. But the stone seldom so exactly fits the cavity of the urethra, that no air can pass. And if all the air be extracted by suction from the whole length of the urethra, the weight of the incumbent atmosphere will compress the whole cavity of the urethra; and so the passage be made narrower for the stone about to make its exit. The Egyptians attempted to dilate the urethra by blowing up the yard; and this method seems useful where the stone is lodged in the urethra; and Prosper Alpinus (*b*) saw several smaller stones, one as large as an olive stone, and another equal in size to a large olive, extracted by this method. Indeed they also attempted to extract stones in the bladder through the urethra dilated by wind: for when they perceived it much enlarged, the finger being introduced into the anus, they tried to push the stone of the bladder into the dilated urethra, and when it arrived near to the prepuce, they removed the pipe suddenly and forcibly from the canal of the urethra, and by this means the stone often followed. Others used pipes of different sizes, beginning with the smallest, and dilated by inflation not only the urethra, but also the bladder itself: when the largest pipe was introduced, a finger being put up the fundament, the operator endeavoured to direct the stone so, as to enter into the cavity of the pipe, then applying his mouth to the other end of the pipe, he tried to extract the stone by suction; *qui si nimis crassus esset, sæpe rumpebatur, sicque in frustra attraheretur. Veluti contigit supra dicto viro Coptito, cui frustum et reliquum lapidis*

(*b*) De Medicina Egypt. lib. iii. cap. xiv. pag. 224, etc.

admodum crassum et durum, intus remansit non educum. “Which if it was too large was fre-

“quently broken, and so extracted piece-meal.

“As happened to the aforesaid Egyptian, in

“whom a piece, and the remainder of the stone,

“very thick and hard, remained behind, not ex-

“tracted.” This last method which is different

from the former, Octavius Roveretus a very

learned physician, who, after the departure of Al-

pinus, practised physic with great reputation

among the Venetians resident in Egypt, commu-

nicated by letter to Prosper Alpinus.

This method seems to have its uses in promoting the exit of a stone fixed in the urethra, provided

the canal of the urethra be rendered lubricous by

previously injecting oil, and a finger be pressed hard

behind the stone, to prevent the inflated air from

getting into the bladder. For then by gently

moving the finger forwards that compresses the

urethra behind the stone, the stone may gradually

be pushed forwards through the dilated and slip-

pery urethra. There seems less hopes of extracting

stones of the bladder by this method, as they ge-

nerally are of a larger size; and it is not so easy to

direct with the finger introduced into the anus,

the stone into the neck of the bladder; especially

in adults; as will hereafter be shewn, where we

shall treat of the different methods of cutting for

the stone.

If the stone is immoveably fixed in the passage,

and cannot be extracted by any means whatever,

Aretæus advises, to try whether it cannot be pushed

back into the bladder with a catheter, and the

urine thus evacuated (c). But he warns us, that

this ought not to be attempted, if an inflammation

(c) Aretæus de Curat. Morbor. acut. lib. ii. cap. ix. pag. 110, 111.

is present: for then *neque meatus instrumentum admittit, et cathetere vulnerantur*. “Neither the
 “ passage will admit the instrument, and there is
 “ danger of wounding the parts.” In the version
 καθέτης and καθετήριον is called an ear probe, that
 seems to be a different instrument from a catheter.
 For Celsus, after he has described copper pipes,
 which were catheters, which he directs to be of different
 sizes to suit every age and sex, he presently
 after says; (d) *Nonnunquam etiam prolapsus in ipsam
 fistulam calculus, qui subinde ea extenuatur, non longe
 ab exitu inhærescit. Eum, si fieri potest, oportet
 evellere, vel oriculario specillo, vel eo ferramento, quo
 in sectione calculus protrahitur*. “ Sometimes a
 “ stone sliding into the urethra, sticks where that
 “ grows narrower, not far from the end; if pos-
 “ sible it ought to be drawn out either by an in-
 “ strument resembling an ear picker, or the instru-
 “ ment with which the stone is extracted in cut-
 “ ting for that distemper.” Moreover in the
 version of Ætius (e) we read, that Philagrius, when
 a stone stuck in the very extremity of the urethra
 near its orifice, and he could not lay hold of it with
 a pair of tweezers, very gradually and gently shook
 it about with a small auricular probe, which seems
 to have resembled the instrument we use for pick-
 ing the wax out of the ears; which is hollowed
 out in one extremity: this being introduced to
 the side of the stone, such a gentle agitation may
 be made, as to give an opportunity of trying,
 whether the situation of the stone can be changed
 by means of this contrivance.

The celebrated Hales, to whom physic is so
 much indebted, proposed the following method

(d) Lib. vii. cap. xxvi. pa. 474. (e) Sermon. Undecim.
 cap. v. pag. 257. (f) Hales's Hæmæstatics on the Animal
 Calculus, page 251.

for the extraction of stones lodged in the urethra (*f*). He directed a pair of forceps to be made, the extremities of which mutually receded from each other by means of an elastic spring, of such a degree of strength as not to act too forcibly, but only moderately dilate the urethra. This pair of forceps was inclosed in a silver tube, to prevent the extremities of the forceps from receding from each other. The tube, with the forceps inclosed, was to be introduced into the urethra quite as far as the place where the stone was fixed, which when it touched, the canula was to be withdrawn, that the extremities of the forceps might both freely recede; which were a little bent towards each other: by this means the urethra was dilated; the forceps was then to be pushed a little farther up the urethra, that the stone might slip between its gaping extremities. This done, the canula was again introduced, in order to close the extremities of the forceps, that they might keep fast hold of the intercepted stone, which then might be extracted.

This instrument was sent to Mr. Ranby the surgeon, that he might try its utility, who witnessed, that it appeared from repeated trials, that stones might quickly and easily be extracted from the urethra, by this method. Whence several other surgeons have adopted the use of this instrument. Ranby likewise judged, that this instrument might be used with great advantage, where the urethra requires dilatation, from its being too narrow in any particular part: but to answer this purpose, the forceps should be left some time in the urethra, every day.

When stones lodge in that part of the urethra, which is situated between the nut of the yard and its curvature near the os pubis, the use of this instrument seems attended with a certainty of suc-

cess. But if the stone should stick beyond this curvature of the urethra, its use will be attended with greater difficulty. However, this instrument might be incurvated like a catheter; and this may easily be done, if the instrument is made of silver.

When all the above means have been tried in vain, if a stone stops up the passage of the urethra, cutting is the only method by which it can be extracted from thence: in this case the urethra must be divided in the very part where the stone is lodged. Aretæus and Ætius both recommend this operation. Celsus describes it (g); who however seems only to approve of it where the stone *non longe ab exitu inherescit* “sticks not far from the end.” These are his words: *cutis extrema quam plurimum attrahenda, et condita glande, lino vincienda est: deinde a latere recta plaga coles incidendus, et calculus eximendus est: tum cutis remittenda. Sic enim fit, ut incisum colem integra pars cutis contegat, et urina naturaliter profluat.* “The prepuce must be drawn out as much as possible, and the nut being covered must be tied with a thread; then on one side a longitudinal incision must be made into the penis, and the stone extracted: after this the prepuce is let loose; for by this means the sound part of the skin covers the incision made in the penis, and the urine will be discharged in the natural way.” Where it is to be carefully remarked, that the loose skin which covers the penis, has changed its place by having been elongated, lest the incision in the skin should answer to the wound made in the urethra. A skilful lithotomist (h) used to turn the skin of the penis round, so that the upper part of the skin, being brought underneath the penis, laid over the

(g) Lib. vii. cap. xxvi. pag. 474.

(h) Jac. Denys over den steen, etc. cap. xiii. pag. 198.

stone, and then made an incision quite through the urethra: which done, and the skin let loose, a small wound remained on the back of the penis, which he covered with a bit of diachylon plaister. And although the patient walked about the city immediately after the extraction of the stone, yet within six days he perfectly recovered, without the assistance of medicine. He only took care not to wound the large artery that runs near the urethra. But if it happened, that the stone had occasioned an inflammation and swelling of the part where it was lodged, in such cases he never made an incision upon that part, because then the skin could not be turned round: but endeavoured to push the stone back, that the operation might be performed on a part not inflamed, and where the skin was loose: otherwise the cure proceeded more slowly. He likewise remarks, that in this case he had made the incision in every part of the urethra where a stone was lodged, even in the perinæum. But if the stone stuck in the very beginning of the urethra, he abstained from performing the operation, till it had made a further progress; or if it totally obstructed the passage of the urine, by introducing a catheter he pushed the stone back into the cavity of the bladder, in hopes, that afterwards, slipping afresh into the neck of the bladder, it might be propelled farther up the urethra: he relates such a case of a stone pushed back (*i*), which in a few days after passed as far as the very orifice of the urethra, so that it was laid hold off with a pair of forceps, and extracted. Moreover he affirms, that he has often seen similar cases.

But where the stone stuck in the extremity of the urethra, and yet could not be extracted, he di-

(*i*) Ibid. pag. 19.

vided the glans penis itself directly upon the stone, which being extracted, the wound soon healed: he affirms that he had frequently met with such cases: he dissuades from making an incision in the lower part of the penis, in this case; because a great hæmorrhage often ensues, and the cure does not proceed kindly: especially in young people, on account of the frequent erections of the part. For as the glans penis is a continuation of the spongy body of the urethra, it is not distended till a very little while before the seed is emitted: whence the penis may be erected, from its corpora cavernosa, or cavernous bodies becoming turgid, though the spongy substance that surrounds the urethra is not yet in a turgid state. In infants and young children, he observes, there is no reason to be afraid of this erection of the penis.

It has been remarked, that stones have perforated the urethra, and been lodged in the glans itself, nay also in the cavernous bodies of the penis; from which places they could not be extracted without cutting (*k*): in such cases, upon introducing a catheter, the stone cannot be felt. It is necessary to remind the surgeon, when the glans is divided, to be careful that the glans does not adhere to the prepuce; which is chiefly to be apprehended, where there is a necessity for dividing the prepuce at the same time; such cases have sometimes happened; principally where the internal surface of the foreskin, has been excoriated by acrimonious urine, or any other cause.

We learn from anatomy (*l*) that the penis consists of two cavernous bodies, which constitute the greatest part of its substance: these are almost cylindrical; and from their being of this shape,

(*k*) Ibid. pag. 190, 194. (*l*) Winslow Exposit. Anatom. Traité du bas Ventre, No. 523, etc. pag. 563.

when they are laid together, an hollow is left on the upper, and on the lower part of the penis: the urethra is placed in the lower fulcus, which is a little larger than the upper one; and strongly adheres to either cavernous body the whole length of the hollow in which it lies. The cavernous bodies of the penis, when laid together, form a middle partition, from the union of their respective transverse fibres: however, the fibres that compose this partition, are not continuous to each other, but leave intermediate spaces, whereby a free communication is formed between the right and left cavernous bodies; for if one cavernous body be inflated with wind, the other becomes turgid also. To this partition, by which the two cavernous bodies of the penis are joined together, the urethra is strongly attached. It therefore appears, that the urethra does not run through the very substance of the penis, but along its inferior part. Whence, if a stone lodges in any part of the urethra, it may readily be felt by passing a finger along the under part of the penis, unless there should be a strong inflammation that occasions a considerable swelling. The situation of the urethra in the penis, and the structure of the cavernous bodies, are elegantly described in the anatomical plates of Ruysch (*m*).

Or by puncturing the perinæum.] If, for example, the patient labours under a total suppression of urine, where a stone, immoveably fixed in the urethra, wholly prevents the passage of the urine, and can neither be pushed back into the bladder, or extracted by an incision made on the part. Such cases chiefly happen, where, from the irritation of a rough or angular stone, the introduction of the catheter performed by an un-

skilful hand, or any other cause whatever, a violent inflammation is brought on, and notwithstanding the best remedies are applied, the tumour does not quickly subside. For then, unless a passage be made for the urine, after intolerable agonies, and a delirium, convulsions, and even death ensue. In such cases nothing remains, but to puncture the perinæum in the part where the incision is usually made in the lateral operation for the stone, which will be hereafter described at § 1436. The celebrated Rau (*n*) performed this operation with the same kind of instrument that he used to draw off the water from the scrotum in an hydrocele; but made thicker and longer, such as has been already described in the chapter on the dropsy. When he thought he had penetrated into the cavity of the bladder, he withdrew the trocar, and so the urine issued freely through the canula. And as in such cases the bladder is distended with a great quantity of urine, there is no dangerous consequence to be apprehended, though the trocar should penetrate rather deep. But in other kinds of ischuries, greater caution is necessary: for unless the bladder be distended, the opposite side of the bladder and other parts might be wounded by such an instrument, if long and more deeply thrust in. If a finger be introduced into the fundament, it may easily be perceived whether the bladder is distended with urine, or not.

But as the discharge of urine affords the most certain sign that the instrument has penetrated into the cavity of the bladder, hence Denys has improved it in the following manner (*o*). In the three square trocar that is used for the operation of tapping in the dropsy, the point that projects

(*n*) Jac. Denys over den steen, &c. cap. ii, p. 185. (*o*) Ibid. cap. ii. p. 187.

beyond the canula is of a pyramidal form, its whole remaining part that is concealed in the canula, cylindrical: he retains this cylindrical form only for about two geometrical lines, that the canula may firmly adhere to the trocar: the rest of the trocar is of a pyramidal shape, and thus between the three flat sides of the pyramid, and the cylindrical sides of the canula, there remains three vacant places, through which the urine can freely pass. For if the whole trocar that lies in the canula was cylindrical, the whole cavity of the canula would be entirely stopped up. Moreover, he directs three small holes to be made in the canula, near the part where the trocar, before cylindrical, becomes pyramidal. When therefore this instrument penetrates the bladder, as soon as the canula arrives about a quarter of an inch within the cavity of the bladder, the urine enters through these little holes, and as the hollow canula is not filled up with a solid cylinder, but a pyramid, the urine, flowing through the extremity of the canula, will afford the surgeon an infallible sign, that the instrument has penetrated into the cavity of the bladder, which is sufficient. The trocar is then withdrawn, and the urinary bladder wholly emptied by means of the open canula: the canula ought to remain in the bladder, that the urine may be freely evacuated; whence it is to be fixed in the part with a proper bandage, which may conveniently enough be done, as appears in the figure (*p*). But as a constant defluxion of urine would prove troublesome, the mouth of the canula may be stopped with a little cork, which is afterwards to be taken out, as often as the patient has occasion to make water.

The method of dilating the urethra in the female sex, to procure a passage for a stone lodged therein, will be described hereafter at § 1438.

S E C T. MCCCCXXXV.

IF it be too large to be extracted by this method, the patient must submit to the operation for the stone.

Where the stone is of such a size, that all the preceeding methods have been tried in vain, and its exit cannot be procured, in such case the patient must either be abandoned to his fate, or the stone extracted by the operation of lithotomy. It is true indeed, that sometimes pretty large stones have made their way out of the bladder without cutting. Thus we read (*q*) of an old man seventy years of age, long afflicted with a stone in his bladder, in whom, without any preceeding laceration, a little fissure burst in the perinæum, and from this aperture the urine began to trickle down, (however, the edges of this fissure were of a whitish colour and rugged.) This fissure by degrees grew wider. On a certain day, when the old man was straining with all his force to make water, a stone of a crooked shape dropt out of the aperture in the perinæum, which weighed two ounces and an half. No purulent matter issued from the wound, but only a substance very like plaister dissolved in water. This aperture, after the expulsion of the stone, degenerated into a fistulous ulcer, and the old man survived this accident some years. A similiar case is recorded (*r*) of a

(*q*) Institut. Bonon. t. i. p. 151. (*r*) Acta Physico-Medica, &c. Natur. curios. t. i. Obs. xvii. p. 60.

boy about five years of age, in whom, from the right superior side of the scrotum, a thin, white, acrid ichor began to exude, which at length formed a large aperture, from which was extracted *calculus siliceus oblongus, uno prominente extremo acuminatus, et altero obtusus, fabæ magnitudine, et colore ex flavo livescente*; “An oblong stone, pointed at
 “one end, and obtuse at the other extremity, the
 “size of a bean, hard as a flint, and of a livid
 “yellow colour.” This fissure likewise degenerated into a fistula, through which the urine was discharged, and never afterwards resumed its natural passage. But such cases very seldom happen, and always leave behind a fistula, attended with a perpetual filthy draining of urine through the ulcer. Whence a perfect cure can only be expected from the operation of lithotomy; of which we are now about to treat.

S E C T. MCCCCXXXVI.

AN D rather prefer the method called the apparatus major, improved by Rau, as being the most certain.

The extraction of the stone by cutting, has been attempted by different methods. The most ancient method of all, seems to have been that, in which the operator, having previously felt the stone, divided the parts lying on the stone quite through with a knife, and extracted the stone through the wound. To perform the operation, the lithotomist introduced the fore-finger and middle finger of the left-hand, dipt in oil, up the the fundament, and pressing softly with his right-hand above the os pubis, endeavoured to bring
 2 the

the stone towards the neck of the bladder; then making a pretty large incision on the left side of the perinæum above the fundament, directly upon the stone, he turned it out through the wound by pressing it downwards and forwards with the fingers introduced in the fundament, or by means of a scoop, hook, or pair of forceps. As this operation could frequently be performed with the knife alone, or at least required but few instruments, it was named the *Lesser apparatus*, or *Cutting on the gripe*. This method Celsus describes (s). It appears however, that he would not have the bladder wounded; because the ancients always reckoned wounds of the bladder fatal, and therefore he directs that the stone should be brought by the fingers introduced up the fundament, quite to the neck of the bladder. *Cum jam eo venit, ut super vesicae cervicem sit, juxta anum incidi cutis plaga lunata usque ad cervicem vesicae debet, cornibus ad coxas spectantibus paululum: deinde ea parte, qua strictior ima plaga est, etiamnum sub cute, altera transversa plaga facienda est, qua cervix aperiatur, donec urinæ iter pateat, sic ut plaga paulo major quam calculus sit.* “When the
 “stone is brought to rest upon the neck of the
 “bladder, a lunated incision must be made in
 “the skin, near the anus, as far as the neck of
 “the bladder, with the horns pointing a little
 “towards the ischia; then, in that part where
 “the bottom of the wound is straiter, again under
 “the skin, another transverse wound must be
 “made, by which the neck may be cut; till the
 “urinary passage be opened in such a manner,
 “that the wound is something larger than the
 “stone.” But Celsus would have the operator be always careful, not to extract the stone through

(s) Lib. vii. cap. xxvi. p. 477.

too small an incision, by lacerating the parts; for which reason he particularly directs the wound to be something larger than the stone: *Quia calculus iter, cum vi promitur facit, nisi accipit: idque etiam perniciosius est, si figura calculi quoque vel asperitudo aliquid eo contulit. Ex quo, et sanguinis profusio, et distensio nervorum, fieri potest. Quae si quis evasit, multo tamen patientiorem fistulam habiturus est, rupta cervice, quam habuisset, incisa.* “ Because the stone, when
 “ it is brought away by force, makes a passage,
 “ if it does not find one: and this is even more
 “ pernicious, if the shape or asperity of the stone
 “ contribute any thing to it: whence both an hæ-
 “ morrhage and convulsions may ensue. But
 “ though a person escape these, the fistula will be
 “ much larger, when the neck is lacerated, than
 “ it would have been, if that part had been only
 “ cut.” To extract the stone, if it did not drop out spontaneously after the incision was made, he used a crotchet which he describes, not very different from that once employed by modern surgeons; and likewise directs how, and with what precautions it ought to be used: and then says: *Haec est simplicissima curatio.* “ This is the most
 “ simple method.” (t) He afterwards subjoins the cautions necessary to be observed, where stones are not only rugged, but also full of sharp points, lest the bladder be wounded when such are brought towards its neck, by the fingers introduced up the fundament: for when this happens to be the case, *ex distensione nervorum mortem maurant: multoque magis, si spina aliqua vesicae inhaeret, eamque, cum deduceretur duplicavit,* “ they bring on convul-
 “ sions and death; and more especially if any
 “ point is fixed in the bladder, and causes it to
 “ fall in folds as it is brought down towards the

(t) Ibid. p. 479.

“neck.” Lastly, he concludes his observations on cutting for the stone, with these words: *Quocumque autem modo cervix ea parte secta est, leniter extrahi, quod asperum est, debet, nulla propter festinationem vi admota (u).* “Now in whatever method the incision in the neck is made, a rough stone ought to be extracted gently; no violence being used for the sake of expedition.” But as the bladder is situated higher in adults, the stone could either not at all, or with great difficulty be reached by the fingers introduced into the fundament, and drawn down towards its neck. This *Celsus (w)* acknowledges, instructing us that this operation can only be attempted upon a patient, *qui jam novem annos, nondum quatuordecim, excessit.* “Whose age exceeds nine years, and not fourteen.” Notwithstanding, it is certain that this very operation, has been attempted also upon more adult subjects. A blacksmith, a fellow of incredible resolution, who had twice undergone the operation of lithotomy, being a third time troubled with the stone in his bladder, wearied out with these tortures, determined to cut himself. His wife having been sent out of the way, with the assistance of his brother only, who held up the scrotum, while the patient himself holding the stone fast with his left-hand, he with his right made an incision into the perinæum with a knife which he had privately procured, and wounded the part three times before the incision was large enough to admit the stone to pass through it; and as it could not at last be done without great difficulty, he distended the lips of the wound with his fingers till the stone was forced out with a great crash, which proved as large as an hen’s egg, and weighed four ounces. The

(u) Ibid. p. 480.

(w) Ibid. p. 475.

operation being finished, he sent for a surgeon to cure the wound, which he effected, but not perfectly, for a fistula remained ever after (x).

It is well known, that strolling operators both in the last age and the present, have often attempted this method of cutting upon patients of all ages: these kind of people seldom caring about the success of the cure, as they quit the place as soon as they have got the stipulated fee. Now as this bold stroke in some measure succeeded with the above blacksmith, and he survived the operation, no wonder that such rash operators have sometimes, though but rarely, succeeded. Better success indeed might justly be expected, if the operation was performed by a skilful hand. The celebrated Heister attests (y), that he has used this method of cutting for the stone with success. Nay, if in adults the stone sticks so fast in the neck of the bladder, that it cannot be pushed back with a catheter into the cavity of the bladder, he recommends this method of cutting. It sometimes happens that stones of the bladder gravitate towards the perinæum, so that it swells from the stone, which may be perceived there by the touch. It seems as if such stones may be cut out by the lesser apparatus even in adults; as was done in the case of the above blacksmith, who performed this operation upon himself. Sasbaut, formerly a famous lithotomist in Holland, frequently used the lesser apparatus, and with good success. Denys often saw him operate, and indeed the third time, upon a young man, from whom the stone immediately dropped out of the wound (z). However great caution is necessary, lest the adjacent parts be injured; for

(x) Tulp. Observ. Medica. lib. iv. cap. xxxi. p. 325.

(y) Instit. Chirurg. cap. cxi. p. 903. (z) Over den steen der Nieren, blaze. &c. cap. viii. p. 120.

it happened to the above lithotomist, that while making an incision on the part, having pressed the knife rather hard against the stone, the stone broke, and he wounded both his own finger, which he had introduced up the fundament, and the intestine also.

But as cutting for the stone by the lesser apparatus could not always take place, especially in adult subjects, surgeons and physicians invented another method, which they began to use about the beginning of the sixteenth century; and as a far greater number of instruments were required for this new operation, it was called *the greater apparatus*, which was generally used till the beginning of the present age. The invention of this method of cutting is ascribed to Francisco de Romanis, or Romano, it was afterwards improved, and published in a particular treatise by his pupil Marianus Sanctus, in the year 1524; whence it has also been called *Marianus's Method*.

Heister forms a very probable conjecture concerning the invention of this method. (a) Stones, even large ones, are voided by women, or extracted, by dilating the urethra in that sex. Whence hopes were entertained, that if in men as short a way could be procured to the cavity of the bladder, as in women, stones might be voided from thence, or be extracted with equal facility in the male, as in the female sex. Now this and nothing more was effected by the *greater apparatus*. A grooved staff was introduced into the bladder; the integuments and urethra itself were divided on the left-side of the perinæum, near the raphe, or seam of the perinæum, by a strong incision knife, slipped into the groove of the staff: the wound was made in children at least

(a) Institut. Chirurg. cap. cxli. p. 906.

two fingers breadth; in grown persons, it was even three or four fingers breadth long. But the urethra only was wounded, the neck of the bladder remaining unhurt. An instrument called a *male conductor* was introduced along the groove of the staff into the cavity of the bladder; the male conductor being passed, the staff was gently drawn out; upon the male conductor, an instrument called the *female conductor* was introduced, which received in its groove the pointed ridge of the male conductor, and thus descended safely and gently through the neck of the bladder into its cavity: when these two conductors were fixed in the cavity of the bladder, the operator, laying hold of their handles, gradually separated the blades a little from each other to distend the neck of the bladder, that it might by this means more readily admit the forceps shut close, which were cautiously introduced into the bladder between the two conductors. Heister directs (b) that before the forceps are passed into the bladder, the operator should introduce gently between the two conductors, the fore-finger of the right-hand previously dipped in oil, in order to dilate the neck of the bladder further, that the forceps may enter the more easily. Others used only one conductor, and that a grooved one, upon which, introduced into the cavity of the bladder, they conducted the forceps shut close into the bladder. The forceps was known to have entered into the bladder, when its blades could with ease be extended and separated from each other. When this circumstance was fully ascertained, the conductors were gently withdrawn, and the forceps was divers times opened and shut in order to dilate the neck of the bladder still more.

(b) Ibid. p. 912, 913.

But lest the membranous coat of the bladder, during these attempts, should be laid hold of by the forceps, this instrument was constructed in such a manner, that although shut, yet a vacant space was left between the extremities of the two blades. The stone was sought for with the forceps shut, and when found was caught hold of by opening the blades, and afterwards extracted with caution, the forceps being pressed down against the gut rectum, where the space is greatest.

By this method it was supposed a passage might be prepared for the stone, through the dilatation of the neck of the bladder, without wounding that part. But Le Dran, so celebrated for his chirurgical knowledge, candidly confesses, (c) that he has seen upon dissection, in subjects who had died after this operation *cervicem (vesicae) in magno hoc apparatu omnibus his actionibus non solum expandi sive diduci, sed potius integram cervicem, a fine incisionis usque ad vesicam ipsam, semper findi ac dilacerari.* “The neck of the bladder in this greater apparatus, by all these operations, not only expanded or dilated, but rather the whole neck, from the end of the incision quite to the bladder itself, always slit up and lacerated.” He says indeed this laceration may be made without injury, *si modo negotium pedetentim, et curate, instituat.* “Provided the business be done very gradually, and carefully.” But as the parts cannot be preserved in an whole state by the *greater apparatus*, will it not be better to divide than lacerate them? Truly this may be done in less time, and with far less pain to the patient, and the wound will be much easier cured. If lithotomy by the *greater apparatus*, be attempted with great force and haste, there is danger of its

(c) Ibid. p. 213.

proving fatal, and many have died convulsed while the stone was extracting; should more prudent surgeons lacerate these parts slowly and gradually, how lasting the tortures! especially if the stone proves large, or of an irregular form. After this operation, the sphincter of the bladder being over stretched, and afterwards lacerated, a disagreeable and troublesome incontinence of urine ensues, that torments the miserable patient the whole remainder of his life; nor is this accident unfrequent. If the stone should be very large, no force whatever could extract it; hence the patient would either die under the operation, should the surgeon obstinately persist in attempting an impossibility; or the stone be left in the bladder unextracted. We read in Celsus (*d*) that Ammonius, when a stone was so large that it could not be extracted through the wound, by splitting it, reduced it into lesser pieces. *Unco calculum prehensum firmabat; tum ferramentum adhibebat crassitudinis modicæ, prima parte tenui, sed retusa, quod admotum calculo, et ex altera parte ictum, findat; magna cura habita, ne aut ad ipsam vesicam ferramentum perveniat, aut calculi fractura ne quid incidat.* “ He fixed a crotchet upon the
“ stone with so sure an hold as to prevent its
“ recoiling inwards: then an iron instrument of
“ moderate thickness, with a thin edge, but not
“ sharp, was applied to the stone, and being
“ struck on the other side cleaved it; great care
“ being taken, that neither the instrument came to
“ the bladder, nor any thing fell in by the break-
“ ing of the stone.” But the difficulty of preventing the splinters of the stone split to pieces by the wedge, from escaping into the bladder, is evident; nor truly can the stone be easily held

(*d*) Celsus, lib. vii. cap. xxvi. p. 481.

so firmly, that the stroke upon the wedge shall not alter its situation. Hence no prudent person will imitate this practice.

Others advise the stone to be broken to pieces with a strong large pair of forceps; and the different pieces to be extracted afterwards (e). But if this method be adopted, the forceps must be repeatedly introduced, and withdrawn, through the lacerated neck of the bladder; whence greater irritation, and a dangerous inflammation would certainly ensue; which in such cases almost always proves fatal. Whence Celsus observes (f), *ita longa inquisitione vesica laeditur, excitatque inflammationes mortiferas; adeo ut quidam, non secti, cum diu frustra per digitos vesica esset agitata, decesserint.* “By long search the bladder is hurt, and
 “ mortal inflammations are brought on, inasmuch
 “ that some, though they were not cut, when
 “ the bladder has been long, and to no purpose
 “ handled by the fingers, have died.” Whence it is sufficiently apparent, that an incision of the parts is preferable to a violent laceration, where a large stone is to be extracted from the bladder; which extraction is sometimes wholly impossible, unless assisted by the knife: the extraction of a stone was attempted upon a man by the *greater apparatus*; the integuments and urethra being cut through, and the forceps introduced through the neck of the bladder, the lithotomist notwithstanding could by no means extract the stone; the celebrated Cheselden being present, was requested to lend his assistance; he accordingly divided the prostrate gland and the whole neck of the bladder, and extracted the stone, which weighed almost twelve ounces; thus the patient recovered,

(e) Heister. Instit. Chirurg. cap. cxli, p. 916. (f) Lib. vii. cap. xxvi. p. 40.

who otherwise would have certainly died (g). This method differs from the *greater apparatus* principally in this particular, that those parts are divided by the knife, which in the former method were very much distended, nay frequently lacerated, in order to make a passage for the stone, through which it might be extracted. This method which was formerly called *the greater apparatus improved*, is at present usually known by the name of the *lateral operation*; and as Rau, a celebrated professor of anatomy and surgery in the university of Leyden, practised this method with success; it hence has been called *Rau's method*.

Every body knows, that about the end of the last century, and the beginning of the present, friar James de Beaulieu, who, with undaunted courage and a steady hand, undertook this difficult operation, instituted a new method of cutting for the stone in France. But as he was ignorant of anatomy, he rather seemed to act from a blind instinct, and it appeared, upon dissection of bodies that had undergone the operation, that friar James did not use one particular method, but sometimes cut one, sometimes another part (h), so that every operation differed from the rest. Whence it is no wonder, that they frequently succeeded unhappily, though some patients were cured by this method. Wherefore many exclaimed against this method, and recounted the mischiefs that were to be apprehended therefrom. The celebrated Morand excellently observes, (i), that this method ought not to be entirely condemned, because it was exercised by a man unskilled in anatomy, but rather attention ought

(g) Academie des Sciences 1731. p. 209, 210. (h) Ibid. p. 214. (i) Ibid. 215.

to be paid to the amendment of those circumstances that seemed rather unsafe: moreover, he proves, that friar James was not indocible, but profited by the instructions of the most able practitioners, who remarked those circumstances which seemed defective and dangerous in his method. Nor does Morand hesitate to assert, that friar James, having learnt better, performed the *lateral operation* in the same way, that the famous lithotomist Cheselden lately practised it with such success in England. For he afterwards operated much more successfully in different parts of France (*k*). Thus when a nobleman afflicted with the stone, before he would submit to be cut by friar James, received into his palace twenty two poor persons afflicted with the same disorder, whom he provided with all kinds of necessaries; friar James performed the operation on them all, and cured every one. After so many favourable experiments, the nobleman, doubtless full of confidence, underwent the operation, and died, certainly worthy of a better fate. These facts happened in the year 1703.

He next went to Amsterdam, and there got such reputation in his profession, that when he departed from thence to go to Brussels, the magistracy of Amsterdam, presented him with a golden medal, stamped with his portrait on one side, and on its reverse the following inscription, *pro servatis civibus*. He afterwards operated in various countries; and at length tired of travelling, returned to his native place Besançon in the year 1712, and about two years after died there, in the sixtieth year of his age.

From these circumstances it appears, that Friar James (*l*) at first made a vague incision; after-

(*k*) Ibid. (*l*) Ibid. p. 218.

wards having learnt better, he kept to a certain method which he used with success, cutting the neck of the bladder, which in the *greater apparatus* was lacerated, during the extraction of the stone.

The celebrated Rau, adopted this method after the decease of Friar James (*m*); and being an excellent anatomist, performed it with great success, and made some improvements on the instruments used in this operation. *Deinde methodo nova sua semper est usus, qua eundem, quem monachus ille, locum incidit* (*n*). “ And from that time “ always made use of his new method, in which “ he divided the same parts, as the friar used to “ do. Now as it is said in the same place, that it had been proposed, not to cut the neck of the bladder, nor the urethra, but the bladder itself laterally very near the neck, &c. and it had been just before mentioned that Friar James cut the neck of the bladder, the celebrated Albinus has endeavoured to elucidate this matter elsewhere, and reconcile these two passages, that at first sight seem absolutely contradictory (*o*).

It seems certain, that those who at present practise this operation with success, divide part of the urethra, the prostrate gland, neck of the bladder, or its orifice, and part of the bladder itself contiguous to the neck: whence this operation may be also called *Urethro-cysteo-tomia*. But it is readily conceived, that this incision requires to be lengthened in proportion to the size of the stone to be extracted by the operation. When Cheselden, as has been just mentioned, extracted a stone that weighed almost twelve ounces, the patient surviving, who was afterwards cured, doubtless there was occasion for a larger incision

(*m*) Albinus de vita Ravii, &c. (*n*) Ibid. (*o*) Annotat. Academ. lib. vi. cap. xiii. p. 148. and lib. viii. cap. xxi. p. 76.

than is commonly made; and a division of the parts seems always preferable to a violent laceration, where dire necessity requires a passage to be made for the extraction of a large stone. What Heister says on this head, deserves an attentive perusal (*p*), where he describes the different methods of cutting for the stone: as also the remarks of Pallucci, an eminent Italian surgeon, on lithotomy (*q*).

Formerly, when reading Homer, I was amazed, that he should have pointed out, a passage not unlike the above, whereby an arrow penetrated quite through into the bladder. For while Harpalion, who had attempted to wound king Menelaus, endeavoured to make his escape,

“ Him thro’ the hip transpiercing as he fled,

“ The shaft of Merion mingl’d with the dead.

“ Beneath the bone the glancing point descends,

“ And driving down the swelling bladder rends.

POPE’S HOMER. (*r*).

The celebrated Rau was so successful in cutting by this method, that in the oration which he made the 26th of Sept. 1713, when he took the professor’s chair of anatomy in the university of Leyden, he asserted, he had performed the operation of lithotomy upon 1547 persons; which he also continued to practise with the greatest success till his death, which happened on the 8th of September, 1719. And as he performed this operation with great dexterity, expedition, and the most happy success, he still cut great numbers during the time he publickly taught anatomy (*s*). *Ægrum statim plerumque in lectum reponi supi-*

(*p*) Institut. tom. ii. cap. cxi. p. 893, &c. (*q*) Nouvelles Remarques sur la Lithotomie, &c. (*r*) Iliad. book xiii.

(*s*) Albinus de vita Ravii, &c.

num curabat. *Vulnus, nec turunda, nec emplastro, nec ligatura, occludebat; sed primis ab operatione diebus servabat apertum. Interim ptisanam, vel tenuem emulsionem, affatim potandum dabat; ut copiosa aqua, in vesicam influens, eam elueret, et, per vulnus patulum continuo effluens, arenulas et sanguinis grumos, et si quid praeterea peregrini adesset, secum abriperet. Quo facto, vulnus dein recentis instar, sanabat, &c. (t).* Quam methodum bene et feliciter eventus postea confirmavit: plerique enim curationi isti gravissimae supervixerunt, ab ea belle se satis habuerunt, et tempore etiam extra fidem brevi sic convalescerunt, ut nec fistula, nec urinae praeter voluntatem effluvium, nec sterilitas, aliaque, quae urina iter sectis accidere solent, eos dein affligerint. “ He generally “ ordered the patient to be immediately laid in “ bed in a supine posture. He neither applied “ to the wound a tent, dossil of lint, plaister, “ or bandage, but during the first days after the “ operation, kept it open. Mean while he directed ptisan, or a thin emulsion to be drank plentifully; that a great quantity of water flowing “ into the bladder, might cleanse it, and being “ continually discharged through the open wound, “ might carry off along with it, sand, clots of “ blood, or any other heterogeneous matter that “ might happen to be lodged there. Which “ done, he afterwards healed the wound in the “ same manner as any other fresh incised wound, “ &c. The happy event afterwards confirmed “ the propriety of this method: for the greatest “ part survived this most severe and dangerous “ operation, were very well after it, and recovered, in so short a time as exceeds belief, so perfectly, that they were neither afflicted with a “ fistula, an incontinence of urine, sterility, or

(t) Ibid.

“ any of those accidents that usually happen to persons cut for the stone by other methods.”

The same method of cutting for the stone was afterwards practised in different parts of Europe by the most eminent surgeons; and many moreover have laboured to devise a method, whereby this operation might be performed more quickly, yet with equal safety. Humanity indeed demands, that the miserable calculous patient should be freed from his tortures with all possible dispatch; but prudence forbids, that the risque of this dangerous operation should be increased by the hurry of the operator.

In this *lateral operation* the neck of the bladder and the prostate gland are cut; sometimes also a portion of the bladder; which however the most eminent lithotomists endeavour to save unhurt; unless the vast size of the stone requires a longer incision; for it seems safer to prepare the stone a passage by the knife, than to lacerate the parts. The integuments being cut through, upon the groove of the staff, previously passed into the bladder, the remaining parts are divided by a dissecting knife, in order to procure a passage for the stone intended to be extracted; and in this manner the whole cutting is terminated, beginning from the external parts. Another method has been used, in which likewise the incision is began from the external parts, though not entirely finished; but through a smaller aperture an instrument is introduced, called the *occult lithotomist*, by means whereof the remaining part of the incision is finished, from within towards the outside. Able lithotomists have entertained different opinions of this method, and the matter has been sharply disputed.

Others

Others have chose to pierce the part with a trocar on the side of the neck of the bladder, and to dilate the wound gently: and as the bladder is very distensible, stones of a large size have by this means been extracted, though the wound made in the bladder, was no ways equal in size to the stone extracted. Thus neither the neck of the bladder, nor the parts of generation are in the least injured, as the bladder is only cut. Now it is a fact, that in the high operation, called also the *hypogastric operation*, the anterior, superior part of the bladder is wounded (*u*); nevertheless it is certain this has frequently been performed with success, though a pretty large wound was made in the bladder. For such wounds of the bladder, provided they do not communicate with the cavity of the abdomen, so that the urine be discharged therein, are not fatal, as experience shews.

But I shall not here enter further into this controversy. The accounts related in the memoirs of the royal academy of surgery, and by De Haen, particularly merit an attentive perusal (*w*).

Eminent lithotomists have always preferred the summer and autumn seasons for this operation, on account of the temperateness of the air: though they undertook it also at any time of the year, if a frequent suppression of urine, intolerable tortures, bloody urine, or extreme weakness apprehended from a further delay, rendered an immediate operation necessary (*x*).

When the patient was afflicted with a violent pain in the loins, Denys chose to defer the opera-

(*u*) Heister Inst. Chirurg. cap. cxlii. p. 626. (*w*) Memoires de l'Academie Royale de Chirurg. tom. iii. p. 623, &c. De Haen's Ratio medendi. tom. vi. p. 180, &c. (*x*) Denys over den steen, &c.

tion, unless the symptoms were extremely pressing, till that pain ceased, or at least was greatly abated: being in hopes, that several stones would shortly pass from the kidneys into the bladder, which might be extracted by the same operation, but otherwise remaining in the bladder, after the cure was effected, might renew the former complaints, and require a second operation. A remarkable case of this kind may be seen (y) of a boy, who was obliged to undergo the operation of cutting for the stone three times in the space of seventeen months.

S E C T. MCCCCXXXVII.

YET is the event of the operation always precarious, by reason of accidents, which no human foresight can provide against, nor art remedy.

'Tis certain indeed, that the skilfulness and dexterity of the operator are best shewn by the successful event of his operations. Nevertheless, all able and honest practitioners agree, that the event of lithotomy is always dubious, and therefore the innocent are often unjustly censured, when the operation proves unsuccessful. For truly it appears, that sometimes such obstacles present themselves, that no foresight could provide against, nor art remedy, though they had been foreseen.

Calculous patients usually suffer their complaints a great while, before they will submit to undergo the operation, terrified at the apprehension of its painfulness, until exhausted with pain, long

(y) De Haen Ratio Medendi. tom. vi. p. 211, &c.

watchings,

watchings, &c. they have almost entirely lost their strength and flesh, so that the poor wretches resemble walking skeletons. Yet even such cases are not to be despaired of: I have sometimes been astonished to behold such emaciated persons, the cause of their pains having been removed by a successful operation, in a few weeks recover their former strength and good case, when recruited by sleep and an wholesome diet.

But it sometimes happens, from too long delay, that the bladder, ureters, and kidneys have undergone such a change, that though the stone be happily extracted, the patient can never recover his former state of health. Whatever morbid affection remains in such cases, is with great injustice attributed to the lithotomist. Beverwyck beheld (z) in the bodies of calculous subjects, the bladder as it were fleshy, so thickened, that it was equal in thickness to a thumb's breadth. I have myself seen it still thicker, and as it were fungous; but at the same time so little coherent, that it would burst upon the slightest handling. In such a state of the bladder, there is danger lest the bladder be perforated by the staff when introduced; and great difficulty will be found in directing the incision; as the groove of the staff, that ought to receive the edge of the knife, cannot possibly be felt in a bladder thickened to such a degree. How little hope remains, that a bladder so disordered, should return to its natural state, even after a successful extraction of the stone! In the body of a person who died of a stone in the bladder, the kidneys and ureters were found greatly dilated, and filled with purulent matter, and the bladder more than a quarter of an inch thick (a).

(z) Steenfuck cap. iv. p. 53. (a) Medical Essays, vol. v. p. 286.

The celebrated De Haen saw a similar surprising degeneration of these parts in a boy, eleven years of age, who had been afflicted with the stone from his earliest infancy (*b*).

Sometimes the internal surface of the bladder is beset with hard callous tumours, which resembling stones, might deceive even the most skilful; sometimes, besides the stone, fleshy fungusses have been found, firmly adhering by their roots to the coats of the bladder (*c*).

Moreover stones have been observed firmly adhering to the bladder; which could not be extracted without lacerating that part; how dangerous this must be, no person can be ignorant; the generality of such subjects die soon after the operation; few are saved. The same holds true, when stones are included in cysts, either wholly or in part. These have been mentioned before at § 1423, where the signs of a stone concealed in the bladder, were treated of. The cases related in the memoirs of the Royal Academy of Surgery, of stones adhering to the bladder, or contained in membranous cysts, deserve particular notice: (*d*) where likewise we learn how much, an undaunted presence of mind joined to knowledge in the profession, and manual dexterity, may avail even in the most difficult cases. For some patients have escaped from so imminent a danger. Such cases formerly were supposed to happen but very seldom; nay some have denied, that they ever did exist at all; however, at present it is clear from faithful observations, that such unhappy cases do not occur so rarely (*e*). An extraordinary case is related of a youth eighteen years of age, whose body was opened after his decease.

(*b*) Ratio Medendi, vol. 1. p. 132, &c. (*c*) Pechlin. Observ. Physic. p. 7. (*d*) Tom. i. p. 395, &c. (*e*) Philos. Trans. Abridged, tom. vii. p. 531. Pechlin. Observ. Physic. p. 4. Tulp. Observat. Med. lib. iv. c. xlvi. p. 355.

About four years before, Senffius had extracted from his bladder, by lithotomy, a stone, *qui cum vesica ita coiverat, ut haec duplicata cum calculo deducetur. Oportuit itaque tunc Senffium calculum agglutinatum diducere; id quod, quamvis digitis agitata fuerit vesica, adeo feliciter cessit, ut nullo periculo orto, felix fuerit curatio, &c. Calculus autem ea parte qua cum vesica commissus fuerat, arenosus et mollis, caeterum satis durus, erat.* “ Which adhered
 “ to the bladder so strongly, that upon attempt-
 “ ing to extract it, the bladder was drawn out in
 “ a doubled state with the adherent stone. Where-
 “ fore Senffius was then under a necessity of di-
 “ viding the stone from the bladder; which,
 “ though the bladder was handled a good deal,
 “ succeeded so happily, that without any bad
 “ symptoms arising, the patient recovered, &c.
 “ The stone, in the part where it had adhered to
 “ the bladder, was gritty and soft, in every other
 “ part of the usual hardness.” The person sur-
 vived the operation above four years; *cum vero perditus et dissolutus esset homo, alio morbo extinctus est. In vesica inventus alius calculus ei tamen haud adherens.*
 “ And at last died of a different disease: upon
 “ opening the body, another stone was found in
 “ the bladder, which however did not adhere to
 “ it (f).”

It sometimes happens, that the stone when grasped in the forceps, breaks to pieces; and as all the bits ought to be extracted, the lithotomist cannot avoid repeatedly introducing, and withdrawing, the forceps, and other instruments; which however is injurious to the bladder; and has frequently been observed to bring on a very dangerous inflammation of the bladder. Whence prudent surgeons have preferred the cleansing

(f) Jo. Ch. Tilling de calcul. ad vefic. adhær. p. 36.

the bladder of such fragments of stone, by injections of warm water through the wound into the bladder, and the patient's drinking large quantity of diluting liquors, rather than irritate it by the continued and frequent application of chirurgical instruments. Heister made use of this method in a like case; and the smaller bits of a stone, were spontaneously voided through the wound; on the fifth day after the operation, a larger fragment presented itself in the wound, which was extracted with a crochet; though at the time of the operation, it had repeatedly slipped away from the forceps (g).

Sometimes a stone of such a size is lodged in the bladder, that it cannot by any means whatever be extracted. Lithotomists indeed, by introducing a sound, and feeling the stone, judge whether a large or small stone be contained in the bladder; but no person can certainly define its size with exactness. Mean while the patient, and his friends, insist upon trying the operation; which performed, the stone has been found so large, that it has not only filled and distended the whole bladder, but also like a proboscis, or trunk of an animal, has stretched out quite into the very neck of the bladder. I have known such a case happen at Vienna, as has been mentioned in the preceding part of this work. The lithotomist, previous to his attempting the operation, had made a very unfavourable prognostic, nor did he attempt by force to extract the stone, a circumstance that was absolutely impossible, lest the patient should die a most excruciating death under the operation: the miserable patient survived the operation some months, and after his decease, such

(g) Medic. Chirurg. und. Anatom. Wahrnehmungen, p. 241.

a monstrous stone was found in the bladder, as has been above described.

One remedy only seems left in like cases, viz. to make an artificial fistula in the perinæum; through which the urine may be evacuated, lest at length the patient perish from a mortal suppression of urine. This was tried by Douglas, an eminent English surgeon, (*b*). By this means the evil is palliated, though not removed, and by such a palliative cure a miserable life is prolonged, and rendered more tolerable. But would such a fistula prove serviceable to those in whom, one stone having been extracted, another is quickly formed? Douglas relates (*i*), that Collet, formerly an eminent lithotomist in France, had made this experiment; and when a new stone was formed, extracted it, by dilating the fistula with a sponge tent, with so little pain to the patient, that he presently after could dress himself, and go about his ordinary business. Collet asserts, that in the space of five years, by this method, he extracted ten stones from the same person.

Where the stone has been extracted by lithotomy, the utmost caution is also requisite, to prevent the external wound from cicatrizing, before the internal wound is perfectly consolidated. For unless this be done, the urine escapes into the cellular membrane, there deposits the calculous matter, and stones are formed, which cause tumours in the perinæum, often troublesome from their great size, and which sometimes produce the worst consequences. This very circumstance happened to a nobleman, of a robust habit of body, subject to calculous complaints from his infancy. About the twenty fourth year of his age, a stone

(*b*) Philosophical Transact. Abridged, tom. vii. p. 536, &c.

(*i*) Ibid. p. 538, 539.

had been extracted from his bladder, of a pretty large size, by the operation usually called the lesser apparatus. Soon after the cicatrization of the wound in the perinæum, he began to feel a pain in that part; which was succeeded by an hard swelling that gradually increased; so that in the space of twenty one years, it equalled in size a Guinea-hen's egg. One day as he was riding in his chariot, from a sudden jolt he felt such extreme pain, that sending for a surgeon instantly, he insisted on his opening the tumour: the surgeon, ignorant of the nature of the disorder, applied a caustic; afterwards, upon cutting through the eschar, he discovered a very hard body that resisted the point of the knife, and by dilating the wound, extracted a large stone that measured in length four inches and an half, in width about two inches and an half, which had been lodged between the bladder and perinæum. The urine ever after discharged itself through this aperture. The nobleman survived this operation seventeen years, and several smaller stones were voided through the same orifice.

After his decease, a stone was found in each kidney; and the bladder wholly schirrous, exceeding the weight of thirteen ounces, had no cavity left; one continued fistulous cavity was observed from the insertion of the ureters into the bladder, quite to the aperture in the perinæum (*).

That eminent surgeon Louis, who has either himself treated, or collected from approved authors, many similar cases, recommends a method of preventing and curing these disorders by bougies prepared of Vigo's mercurial plaister and diachylon with the gums, introduced into the urethra (k). After the extraction of the stone, Celsus

(*) Medical Essays and Observations, vol. i. p. 321, &c.
(k) Academie Royale de Chirurgie, tom. iii. p. 332, &c.

Instructs us that the cure goes on well, (1) *si somnus sit, et aequalis spiritus, et madens lingua, et sitis modica, et venter imus sedet, et mediocris est cum febre modica dolor.* “If the patient sleeps, and his breathing be equal, his tongue moist, his thirst tolerable, his abdomen not swelled, and the pain and fever moderate.” On the contrary, he prognosticates an unfavourable event, *si continua vigilia est, si spiritus difficultas, si lingua arida est, si sitis vehemens, si venter imus turget, si vulnus hiat, si transfiliens urina id non rodit, si similiter ante tertium diem quaedam livida excidunt, si is aut nihil aut tarde respondet, si vehementes dolores sunt, si post diem quintum magnae febres urgent, et fastidium cibi permanet, si cubare in ventrem jucundius sit. Nihil tamen pejus est distensione nervorum, et ante nonum diem, vomitu bilis.* “If there be a continual watching, a difficulty of breathing, a dry tongue, a violent thirst, if the abdomen swells, if the wound gapes, if the urine, that makes its way through it, does not corrode it, in like manner, if before the third day some livid sanies is discharged therefrom; if the patient makes no answers to questions, or very slowly; if there are racking pains; if after the fifth day a violent fever comes on, and a nausea continues; if lying upon the belly is the most agreeable posture. However, nothing is worse than convulsions, and a bilious vomiting before the ninth day.”

It has been observed, that an hiccough has come on during the very extraction of a large stone, and the patient has soon after suddenly expired: whence an hiccough during the operation is justly considered as a fatal omen.

(1) Lib. vii. cap. xxvi. p. 484, 485.

All those things that have been said before, relating to wounds, at § 158 and the following sections, here likewise are to be regarded. For several parts are divided by a sharp instrument; but from the introducing of instruments, and the force used in extracting the stone, the lips of the wound are contused, either more or less, according to the size and ruggedness of the stone; besides, they are constantly irritated by the urine, flowing through the wound for some days after the operation. Prudent physicians endeavour indeed to lessen the acrimony of the urine, by emollient decoctions, emulsions, and the like, drank in large quantities; however some acrimony always remains; especially if the fever runs high. Whence such a wound cannot be cured by the first intention; but an inflammation ensues, the lips of the wound begin to grow red, hot, painful, swelled, and are turned back. If these symptoms prove mild, a purulent discharge will come on, the third or fourth day, sooner or later, attended with an abatement of all the complaints. Whence Celsus says, after having enumerated the good symptoms that gave hopes of an happy event: (m) *In his inflammatio fere quinto vel septimo die finitur.* “In such patients the inflammation commonly ceases about the fifth or seventh day.” On the contrary he considers it as a bad sign; *si post quintum diem magnae febres urgent.* “If after the fifth day a violent fever comes on;” for this indicates an increase of the inflammation; which at this time ought to be much abated, if the cure goes on favourably. Wherefore also a gangrene is then to be apprehended, a frequent consequence of violent inflammation; which Celsus seems to have

(m) Ibidem.

described under the name of a cancer that arises from wounds of the bladder (n).

If to the above be added what has been said at § 162, and the following sections, concerning the mischiefs that attend wounds of the nerves and membranous parts, the reason will be understood of several complaints that sometimes ensue after lithotomy, even when performed by the most dexterous and experienced operator.

Hence likewise we understand, why Celsus (o) to prevent convulsions, which he so greatly dreaded, directs the patient to be let down in a supine posture into a bath of warm water; *ut a genibus ad umbilicum aqua teneat*. “So that he may be “under water from the knees to the navel.” And would have him remain some time in the bath. For he adds: *finis ejus fomenti est, donec infirmando offendat*. “This bathing is to last till “it hurts by weakening.” After that, *multo is oleo perungendus, inducendusque bapsus lanae mollis, tepido oleo repletus, qui pubem, et coxas, et inguina, et plagam ipsam, contactam eodem ante se linteolo (quod duplex aut triplex erat) aceto madens, (p) protegat:isque subinde oleo tepido madefaciendus est, ut neque frigus ad vesicam admittat, et nervos leniter molliat*. “The patient is to be anointed plentifully with warm oil, and an handful of soft “wool saturated with warm oil must be laid on, “so as to cover the pubes, hips, and groin, and “the wound itself, which must still remain “covered with the double or triple linnen cloth “wet with vinegar before mentioned; and this “is to be moistened now and then with warm “oil, that it may both prevent the admission of “cold to the bladder, and gently mollify the

(n) Celsus lib. vii. cap. xxvii. p. 485. (o) Ibid. cap. xxvi. p. 483. (p) Ibid. p. 482.

“nerves.” What expectations the antient physicians formed from the use of oil for the prevention of convulsions, and asswaging of the most acute pains, have been already mentioned at § 164 and 234. The most eminent lithotomists even of the present times successfully employ oil in this method. But Celsus condemns the use of cataplasms applied to the hypogastric region (q): *ea plus pondere nocent, atque vesicam urgendo vulnus irritant, quam calore proficiunt. Ergo ne vinculum quidem ullum necessarium est.* “These do more hurt by their weight, and by pressing on the bladder, irritate the wound, than they do service by their warmth: and for this reason, not the least kind of bandage is necessary.”

In cutting for the stone some hæmorrhage always happens, as the wound is large; but this, provided it is moderate, will not prove injurious; whence Celsus says (r): *Calculo evulso, si valens corpus est, neque magnopere vexatum, sinere oportet sanguinem fluere, quo minor inflammatio oriatur.* “When a stone is extracted, if the patient be strong, and not greatly spent, we may let the blood flow, to lessen the inflammation.” But if the hæmorrhage is violent, especially in weak patients, he would have it suppressed; *ne vis omnis intereat. Idque protinus, in imbecillioribus, ab ipsa curatione faciendum est.* “Lest the strength be entirely exhausted: and this is to be done immediately after the operation, in weak patients.” If the larger branches of the arteries that are distributed to these parts should be wounded; the hæmorrhage, unless stopped, would endanger life. Now as the course of the arteries is so various in different persons, can this always be avoided? The celebrated Rau, who cut such numbers with

(q) Ibid. p. 483. (r) Ibid. p. 482.

success, was of opinion, that he could avoid these profuse hemorrhages by his manual dexterity. To the best of my knowledge, he never communicated the cause of his success, unless perhaps to one person, Denys, whom I have so repeatedly mentioned. Denys succeeded Rau in the profession of lithotomy, and I have sometimes been present when he has cut for the stone. After he had divided the integuments, he introduced his fore-finger into the wound, examined it, and sometimes kept his finger some time in the wound, while with the other hand he seemed gently to alter the situation of the staff in the bladder: then withdrawing his fore-finger, he completed the operation with an incision knife let into the groove of the staff. The most able judges suspected, that by this means he meant to examine, whether the pulsation of an artery could be felt in the place where the incision was intended to be made; in which case he moved the back of the staff a little aside, and thus avoided an hæmorrhage. But this is mere conjecture only; for he and Rau were equally famous for their success in operating, and equally taciturn till death. The following method is that which Celsus used to restrain a dangerous hæmorrhage: *Desidere is debet in acetum, cui aliquantum salis adjectum sit. Sub quo et sanguis fere conquiescit, et adstringitur vesica, ideoque minus inflammatur. Quod si parum proficit, agglutinanda est cucurbitula, et in genibus, et coxis, et super pubem,* (s) “ The patient ought to sit down in sharp vinegar with the addition of a little salt; by which means both the blood commonly stops, and the bladder is contracted, and therefore is less inflamed. But if that does little service, a

(s) Celsus, lib. vii. cap. xxvi pag. 448.

“ cupping

“cupping vessel must be applied both on the
“knees and hips, and also above the pubes.”

That a derivation of the humours may be safely made from a wounded part by means of cupping instruments is a known fact, and that thus an opportunity of contracting themselves is afforded to the divided vessels. But no modern surgeon, I believe, will easily be induced to irritate a recent wound with sharp vinegar, much less, *oriculario clystere, acre acetum nitro mixtum per plagam in vesicam compellere: nam sic quoque discutiuntur, si qua cruenta coierunt.* “To inject through the wound
“into the bladder with a syringe, a mixture of
“vinegar and nitre: for if there be any bloody
“concretions, they are thus dissolved.” (t) At present indeed, the cavity of the bladder is cleansed; when grumous blood, or bits of a stone have lodged therein; but this is effected by the most emollient decoctions, injected lukewarm, as gently as possible, and therefore with success.

The wounded vessel is far more safely secured by a ligature; but when it lies out of the reach of the needle, the hæmorrhage is stopped by a bit of agaric formed in a conical shape, and applied to the mouth of the bleeding vessel; a practice that, as we read, has sometimes proved successful (u). Nay, in a very dangerous case, where an inflammation and excoriation of the scrotum, thighs and buttocks, ensued, and afterwards a gangrene, the patient was saved by the Peruvian bark; detergent injections prepared of bark, being also thrown into the bladder; and the same mixed with digestive unguents and honey of roses, was applied to the lips of the wound.

(t) Ibid. pag. 449. (u) De Haen's ratio medendi, pag. 202, 206, 207.

S E C T. MCCCCXXXVIII.

IN women, the stone is extracted by dilating the urethra, for they seldom require the operation of lithotomy.

As the urethra in women is short, straight, and easily dilated, they far more seldom require the operation than men; for stones lodged in the bladder, in the female sex, are commonly discharged without much trouble, before they have attained to a considerable bulk. Observation teaches, that many large stones have been happily discharged from women, through the dilatation of the urethra. I have mentioned in § 1424, what Tulpius relates of an old woman eighty-nine years of age (*w*), who thus voided a stone which weighed three ounces and a quarter, without the assistance of art; however, a troublesome incontinence of urine, was the consequence; which is not to be wondered at, as the sphincter of the bladder must have suffered great injury, from the pressure of so large a substance.

We read a similar case of a poor woman sixty-three years of age (*x*), who for three years, had undergone such excruciating tortures in the urinary passages, that she was worn away to a mere skeleton, and had given up all hopes of life, but was at length relieved by drinking plentifully of marsh-mallows tea for some months. At the expiration of which time, she suddenly perceived a very unusual weight within her, attended with an inclina-

(*w*) Observat. Medic. lib. iii. cap. vii. pag. 191. tom. v.

(*x*) Philosop. Transact. abridged, vol. vii. pag. 534.

tion to go to stool, and straining forcibly to answer that necessity, a stone, that weighed above three ounces, burst from her with some explosion in the presence of her attendants. Her pains now abated, and a less hæmorrhage ensued, than might have been expected from the violent dilatation caused by such a stone. Thus freed from her constant tortures, she recovered her health, but laboured under an incontinence of urine, which is certainly a very troublesome complaint.

To avoid this evil, some able operators have hit upon an improvement, by which the sphincter of the bladder is not torn by a sudden violent effort, so as to lose all power of contracting itself in future; but the urethra may be gradually dilated, so as at length to admit of the introduction of the forceps to extract the stone from the bladder. Sir James Douglas (y) used to dilate the urethra by means of tents made of gentian root, or prepared sponge; many other methods have also been invented, which are described by the same author.

But an experienced and able professor (z), who read public lectures on surgery and lithotomy at the royal hospital in Florence in 1756 with great applause, gives us a description and an elegant design of an instrument (a), by which the urethra and sphincter of the bladder may be very gradually and gently dilated, so as to render the extraction of the stone safe and easy, from this previous dilatation of the parts. The event has proved the utility of this dilator: in the presence of several able practitioners, he extracted from a girl of sixteen years of age, in about ten minutes, a very hard stone, that weighed an ounce and an half.

(y) Heister. Institut. Chirurg. tom. ii. par. 2. sect. 5. cap. cl. pag. 1028. (z) Dominic. Masetti sopra la litotomia delle donne 4to. (a) Ibid. pag. 23. and the following pages.

The hæmorrhage was small, and she was so completely cured, that in forty days after the operation, she could habitually retain her urine, and returned home to her friends, in perfect health.

This method being tried upon a girl, ten years of age, who for six months had constantly suffered the most excruciating pains imaginable in the neck of her bladder and bowels, with a perpetual involuntary discharge of the urine, was attended with the same success.

Seven years after, in 1763, the same author published another treatise, (*b*) wherein many other cases are related of stones, some of which are said to have been of considerable size, which were extracted by this method, without any further assistance of art. A great many other happy cures have been effected by the same method. This work also gives, a complete description of the same instrument, which, though at first extremely useful, had been since improved by that excellent artist Fr. Giovan. Maria Poggi Servita, so as not only to answer the purpose of dilating the urethra and sphincter, but also to act as a forceps when in the bladder, and extract the stone, if not very brittle; (*c*) whereby the operation is much facilitated, the dilatation of the passages, and extraction of the stone, being both effected by the same instrument.

Celsus likewise acknowledges this to be the most easy method of extracting stones from the bladders of females. (*d*) He also practised an extraction of the stone by a crotchet, when fixed fast in the urethra. But though the larger stones necessarily require cutting, he makes no mention of introducing the forceps through the dilated

(*b*) La lithotomia delle donne perfezionada. 8vo. (*c*) Ibid. p. 72, and the following pages. (*d*) Celsus lib. vii. cap. xxvi. p. 448.

urethra into the bladder, to grasp, and extract the stone. Nevertheless he observes a difference in the manner of operating (e): *sed virgini subjici digiti tanquam masculo debent, mulieri per naturalia ejus. Tum virgini quidem, sub ima sinisteriora, mulieri vero inter urinae iter, et os pubis, incidendum, et sic, ut utroque loco plaga transversa sit. Neque terreri convenit, si plus ex mulieris corpore sanguinis profluit.* “ But in a virgin the fingers should be introduced into the rectum as in a man; in a married woman by the vagina. Again in a virgin, the incision must be made below the left lip of the pudendum, but in a married woman, between the urinary passage, and the bone of the pubes; the wound also must be transverse in both places; and we need not be alarmed, if the hemorrhage be considerable from a female body.” We read in Rau, that he had observed this distinction of Celsus; for after having described the lithotomy of males, he subjoins the following sentence. *Et licet haec res majorem in faeminis difficultatem habere videatur, iis tamen eandem curationem adhibuit, modo viro non usae fuissent, nec peperissent, atque in iis etiam successu non caruit.* “ And though this matter seems to be attended with greater difficulty in women, yet he used the same method of cure for them, provided they had not been connected with men, nor had borne children, and even in them the operation did not prove unsuccessful.” But he does not mention, how married women, or those who have borne children, are to be treated. Yet, notwithstanding, some approved of introducing a grooved staff into the bladder, and then making an incision through the vagina and bladder

(e) Ibid. (f) Albin. Index Suppell. Anatom. et ibid, c. 1. Ravii vita, &c.

directly over the groove of the staff, with an incision knife. Bussiere (*g*) advises, the fingers to be introduced into the vagina, the stone to be brought as near the neck of the bladder as possible, and the incision to be made through the vagina and bladder directly upon the stone. He affirms, that he cut an Hamburgh woman by this way, from whom he extracted a stone that weighed five ounces and an half, who recovered perfectly well. Some others approved of cutting into the bladder through the hypogastric region. This was generally termed *the high apparatus*. What Heister has collected concerning these matters deserves a serious reading (*b*).

An ingenious surgeon, not many years ago, (*i*) gave us a description and design of a double incision knife for lithotomy, which he directs to be introduced through the female urethra into the bladder; which done, the two blades of the instrument, rise up from the sheath, and when the instrument is withdrawn, divide both sides of the neck of the bladder and urethra, so that a large opening is made, for the extraction of the stone. This experiment has been made with success upon many dead bodies, without injuring any other parts, but whether it has been tried upon a living subject, or not, I cannot say.

(*g*) Lateral. Operat. Hist. Jac. Douglas, p. 82. (*b*) Heister Institut. tom. ii. pars 2da. sect. v. cap. cli. pag. 10, 28, &c. (*i*) Poteau Melanges, de Chirurgie, p. 517, &c.

S E C T. MCCCCXXXIX.

IF lodging in the neck of the bladder, it entirely obstructs the passage of the urine, push the stone back with a catheter or sound.

The proper methods that are to be taken when a stone is immoveably fixed in the urethra, have been mentioned in § 1434, but if it is lodged in the neck of the bladder, it may be forced back into the cavity thereof with the help of a catheter or sound.

F I N I S.

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